

Concrete

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The Brittleness of Glass and the Future of Cement

RECENTLY this magazine ventured to point out that great new things may be expected of portland cement concrete when the cement industry takes somewhere near as much interest in research in the direction of improvement of the quality of cement, to meet different uses, as it has taken in research bent upon learning the best way to use cement in concrete construction.

A great deal is lost by a complacent attitude—by assuming that certain things are so and must remain so. One day not long ago P. H. Bates, sitting at his desk in the Bureau of Standards, dropped a few remarks on the value of research and upon the value of research especially in the cement industry. He cited an instance in the glass industry. One or two glass producers were not satisfied with the quality of glass that is being made for spectacles. It was pointed out that spectacle glass, lens glass, broke too easily. If a man drops his spectacles on a concrete sidewalk they usually go to pieces. A good many of the glass manufacturers were complacent in the face of this condition.

"Of course," they said, "glass is brittle; it is bound to break with careless handling."

Others insisted that because glass is brittle it needn't always be that way, and they went about correcting the greatest limitation of glass. They found a treatment, discovered by means of research, and not an expensive treatment, either, by which glass is now being produced which is not brittle, as brittleness in glass is ordinarily understood. Mr. Bates picked up a spectacle lens from his desk, tossed it up to the ceiling, allowed it to come down on the concrete floor of his office, from which it rebounded without damage. Not only that, but Mr. Bates threw it on the floor several times. The glass neither broke nor cracked, nor was it so much as nicked.

The smug glass manufacturer said: "Glass is brittle." The expectant glass manufacturer who believes in the future said: "We'll make glass that is not brittle," and he did.

* * *

Fires and Fire Losses

IT is possible that a developing consciousness that our fire losses in this country are excessive, is crystalizing into what might be dignified by the name of a movement to correct an economic condition. Manufacturers of fire-resistive materials and of fire-fighting and retarding apparatus will have a Fire Prevention Exposition, Octo-

ber 2 to 7 at the Twenty-second Regiment Armory, New York City. The idea of the exposition originated with the Fire Prevention Committee of the National Association of Insurance Agents, as a part of its program of fire prevention activities. It has been endorsed by the National Fire Protection Association, the National Association of Credit Men, by President Frank G. Reynolds, of the International Association of Fire Engineers, the National Board of Fire Underwriters, and other organizations.

At the present rate of burning, property worth \$1,300,000 is being destroyed every day. This financial burden is borne by business men generally in spite of the popular belief that it shifts itself to fire insurance companies. The fire insurance companies simply pay out \$1,300,000 a day that has been paid to them in premiums by the public. The public stands the loss.

The exposition will be a success if it stirs in the public some notion of where the emphasis in reducing fire losses needs to be. If we are merely to shift our burden from premiums to the fire insurance companies, to the expense of half measures in fire-fighting, we make no headway. We need to begin at the beginning and build so there will be a constantly decreasing number of fires to fight.

A. E. MacKinnon, of 405 Lexington Avenue, New York, is chairman of the Exposition Committee.

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Coal, Cars and Cotton

THE cement industry uses about seven million tons of coal annually, when it is to be had. The price of cement has again been skyrocketing in numerous busy local markets, as a result of coal shortage at the mills.

The equivalent of 377,000 box cars of 50-ton capacity each were required to haul last year's cement output to the consumer. If the textile strike ties up the production of cotton bagging mills it would also have a serious effect on the cement industry, inasmuch as thirty million new cloth sacks are needed every year by the cement mills, in which to ship their product. These sacks require an immense amount of cloth—a strip 30 in. wide and over 17,000 miles long. Coal, cars, and cloth are all contributing to delay the consumer.

* * *

The Ideal Road

THE construction of the Lincoln Highway's ideal sections is worth while. This strip of model road, in Lake County, Indiana, on which work has started after nearly two years of research, recognizes not merely engineering skill, but some of the aesthetics which engineers are sometimes accused of neglecting. The work is

under the direction of Stone & Webster, Inc., of Boston, Mass., as agents for the Lincoln Highway Assn., and contracts have been let to J. C. O'Connor & Sons, Fort Wayne, Ind. The road will cost with all appurtenances about \$100,000 a mile, part to be borne by the state of Indiana, part by the Federal Government, part by Lake County and the balance by the Lincoln Highway Association.

The design was worked out by fifteen of the foremost experts in highway engineering and carried to completion through the engineering department of the Indiana State Highway Commission, C. Gray, State Highway Engineer; Lockwood, Greene & Co., engineers, and W. G. Thompson, formerly State Highway Engineer of New Jersey, the Lincoln Highway Association's consulting highway engineer.

The design calls for a width of 40 ft., with a thickness of 10 in. of reinforced concrete. The cost includes the beautification of the roadside with both trees and lighting standards. A road without trees is merely a means of getting from somewhere to somewhere, with beautiful trees it is worth while in its own right.

\$190,000,000 Authorization Aids Road Construction

Federal aid for road construction will be continued as a result of the authorization of additional appropriations for this work amounting to \$190,000,000 carried by the postoffice appropriation bill signed by the President June 19. Fifty million dollars is authorized for the fiscal year beginning July 1, this year, and \$65,000,000 and \$75,000,000, respectively, are authorized for each of the two succeeding fiscal years. In addition, \$6,500,000 is authorized for forest roads for each of the two fiscal years beginning July 1, 1923, and July 1, 1924. The funds will be administered by the Secretary of Agriculture through the Bureau of Public roads.

The apportionment to be made to the various states is approximately as follows:

	Fiscal Year Ending 1923
Alabama	\$1,035,614
Arizona	702,188
Arkansas	836,095
California	1,641,399
Colorado	894,117
Connecticut	320,599
Delaware	243,750
Florida	591,217
Georgia	1,331,972
Idaho	625,691
Illinois	2,164,187
Indiana	1,805,904
Iowa	1,401,915
Kansas	1,401,521
Kentucky	944,786
Louisiana	664,660
Maine	463,440
Maryland	427,986
Massachusetts	730,784
Michigan	1,499,688
Minnesota	1,415,731
Mississippi	863,271
Missouri	1,632,086
Montana	1,081,257
Nebraska	1,054,126
Nevada	685,624
New Hampshire	243,750
New Jersey	628,581
New Mexico	793,216
New York	2,464,299
North Carolina	1,139,556
North Dakota	776,476
Ohio	1,882,003
Oklahoma	1,168,226
Oregon	788,443
Pennsylvania	2,265,969
Rhode Island	243,750

South Carolina	707,492
South Dakota	802,707
Tennessee	1,098,461
Texas	2,950,115
Utah	560,278
Vermont	243,750
Virginia	971,219
Washington	785,806
West Virginia	534,906
Wisconsin	1,263,211
Wyoming	628,078
Total	\$48,750,000

These funds must be matched by the states, and will be administered subject to the general provisions already in force. Announcement from the Department of Agriculture continues:

The new legislation reduces the maximum participation on the part of the Government from \$20,000 to \$16,250 per mile for roads constructed with the appropriation for the next fiscal year, and \$15,000 per mile thereafter. Bridges over 20 ft. in span may be considered as separate projects, to which this limitation does not apply. In states where more than 5% of the area is unappropriated public land, provision is made for an increase in the amount per mile. The act also provides for the extension of Federal aid to the construction of structures required for the elimination of railroad grade crossings.

Important provisions of previous acts under which large funds have been successfully administered are applicable to the new funds. States must maintain adequate highway departments. Funds to match Federal aid must be placed under the direct control of the State Highway Department. The type of surface constructed must be adequate for the traffic anticipated, with reasonable grades, curves and other features. States must obligate themselves to maintain all Federal-aid roads constructed, and in case this is not done any Federal funds available for new projects may be withheld until they are put into satisfactory condition. All Federal-aid funds must be spent on a connected system of roads consisting of not more than 7% of the total mileage in each state, and divided into primary or interstate roads and secondary or intercounty roads.

PLANS RECEIVED FROM ALL BUT EIGHT STATES

Plans for the proposed system have been received by the Bureau of Public Roads from all but eight states, and the state systems are being coordinated so that when joined together they will serve the best interests of the whole country. In the meantime, only projects certain to be on the proposed system are being approved.

The new appropriation comes at a time when several states are nearing the limit of funds available. The authorization of funds for three years in advance will be of great benefit to all states, in that it will permit them to lay their plans for some time ahead. Uncertainty as to future Federal aid is removed and provision can be made at once for raising state funds to match it.

What the new funds will mean to the country can be judged by the use that has been made of the \$350,000,000 previously appropriated. On May 31, 17,000 miles of road had been completed, and, in addition nearly 14,500 miles were under construction. Federal-aid roads in all stages total nearly 38,700 miles, involving over \$287,500,000 of Federal aid. To match this fund the states have appropriated approximately \$380,000,000, making a total of \$667,500,000.

All types of road have been constructed with Federal aid to meet the varying conditions in the United States. The average cost per mile has been \$17,120, and Federal aid has amounted to 43% of the total cost.

It is estimated that the \$190,000,000 lately authorized will result in the construction of more than 25,000 miles, which, added to the 46,000 miles that is expected to result from previous appropriations, makes a total of 71,000 miles, or nearly 40% of the estimated 180,000 miles of road in the system of Federal-aid roads now being outlined.

This magazine serves best as a bureau of exchange—have you contributed an idea lately to the common budget of ideas?

Muscle Shoals—The Wilson Dam

By LITTELL McCLUNG

After nearly a year and a half of inactivity and delay, work begins October 1 on Wilson Dam, the largest concrete structure of its kind in the world, and the most magnificent hydro-electric project ever undertaken.

If the Ford offer for Muscle Shoals is accepted by Congress before October 1, then Ford will finish Wilson Dam and the other dams he plans on the Tennessee. If his offer is not favorably voted on by this date, then the Government will attempt the job and continue work until it is definitely settled whether Henry Ford or the Government will complete and operate the vast concrete hydro-electric project.

The construction of Wilson Dam will serve five great purposes:

(1) Harnessing tremendous cheap power for new triumphs in swift, low-cost smelting and combining ores through the electric furnace.

(2) Making the Tennessee River navigable over Muscle Shoals, and thus, for the distribution of manufactured products, opening up to the Shoals industries the entire navigable length of the Tennessee, Mississippi and Ohio rivers.

(3) Controlling flood waters behind Wilson Dam and other dams up the river, and thus reclaiming to safe and permanent agriculture thousands of acres of fertile overflow territory.

(4) Making several major industries independent of coal and possible coal shortage.

(5) Inspiring hundreds of large and small communities and individuals, through the power ranges of America, to harness their creeks and rivers to serve economically their needs in light and power, as the Muscle Shoals project will serve the people of the entire country.

Planning and building Wilson Dam are a feat in engineering and construction. It will be a monolith, of course, with strength consistent throughout. Owing to immense pressure continuously through years, decades, and, maybe, centuries, it must be "toed into" the solid limestone bed of the river, and it must be one with the banks. Under the dam deep holes have been drilled in the rock and tests made under air pressure for possible crevices beneath the waters. Should seepage develop at any time, concrete can be shot through these holes to stop the leak. Some engineers have had doubts about the south bank of the stream. Already tunnels have been dug into it for long distances, following gravel strata, and these will be filled with concrete.

The building of Wilson Dam will bring into action the

most extensive equipment ever concentrated for such work. First there is the 25,000 h. p. steam plant at Gorgas, on the Warrior River, 85 miles distant, which the Government built in war time to supply power for work at Muscle Shoals.

Over its high-tension lines will come the current for operating the cranes, loading and unloading, excavating the river rock, running the crushers and mixers, and pouring the concrete. Twenty-seven miles of standard gauge railway on the south and north banks; 26 locomotives and more than 200 box cars, flat cars, dump cars, and gondolas will be brought into use.

The electrically operated concrete mixers and rock crushers on Jackson Island, just below Wilson Dam, make the largest concrete plant of its kind. In it are two 4-cu. yd. Smith mixers, that are timed to produce 2,000 cu. yds. a day. The capacity of the two mixers, however, is about 2,500 cu. yds. per day. This amount

can be turned out whenever pouring on the dam makes it necessary.

A Gates gyratory rock crusher has a 48-in. breaker, that can take a 4-ft. cube of stone. There are four 14-in. secondary McCully crushers of gyratory type. When the rock has passed through the milling of these, it is hoisted to an immense screen on top of the structure. The stone that is caught by the screen is turned down a rejector chute and into two 14-in. McCully supplementary crushers that reduce it to sizes suited to use.

MUSCLE SHOALS is tremendously significant because there are hundreds, and even thousands of smaller Muscle Shoals in various parts of the United States.

It is estimated that this country has 20,000,000 potential horse power in its rivers and smaller streams. Nearly all of this vast energy is as yet unharnessed. Once controlled, through permanent concrete construction, it offers the least expensive power that can be obtained from nature. Not only towns and cities, and small and large corporations, but individual families can have their water power developments for perpetual service in the home and in daily tasks.

Through the use of concrete and modern electric installation the ancient and eternal principle of the water wheel will come into uses undreamed of by the ancients or even by our grandfathers, who ran the grist mills in the Eastern and Southern mountains.

Muscle Shoals is the great beginning. The extent of the development no one can now predict.

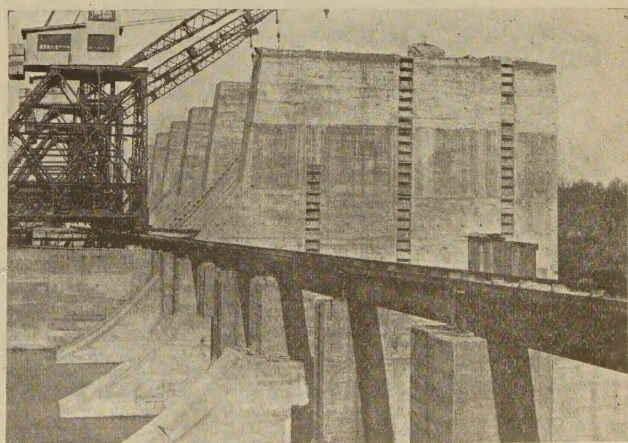


FIG. 1—CONCRETE CONSTRUCTION ON SPILLWAY SECTION OF WILSON DAM

The great crusher and mixer is operated by electric power from the Gorgas steam plant in the Warrior coal basin, about 85 miles distant. This plant, a part of the Muscle Shoals properties, was built by the Government during the war to facilitate work on the Shoals projects.

Rock comes from the Waco quarries, a part of the Muscle Shoals properties, 25 miles south of the river. Cement is bought from the mills. Sand and gravel are dredged from the river bed about 10 miles below the dam, and transferred to bunkers in electrically operated buckets. For use in these operations are two hydraulic dredges, screening plants, launches, five tow boats and 21 barges.

The structure itself will be in three integral parts: the locks along the north bank, the non-overflow and spillway sections of the dams, and then the power house at the south end. Finally will come the superstructure for carrying the Jackson highway and the Lee highway over the river. The lock chambers cut through limestone, will be 300 ft. long and 60 ft. wide, with two lifts of 45½ ft. each. The power house will

Facts About Wilson Dam

It will be the largest concrete structure of its kind in the world, and the greatest hydro-electric development on the globe. Comparisons, in cubic yards of masonry in ten world-famed projects are: Roosevelt, Arizona, 344,000; Poona, India, 360,000; Tansa, India, 408,520; Olive Bridge, New York, 488,200; Arrowrock, Idaho, 530,000; Keokuk, Iowa-Illinois, 540,000; New Croton, New York, 855,000; Kensico, New York, 942,000; Assouan, Egypt, 1,179,000; Wilson Dam, Alabama, 1,260,000.

Wilson Dam is across the lower reaches of Muscle Shoals of the Tennessee River, in northwestern Alabama.

It is about one-third done. When completed its total length will be 4,500 ft. Width of the dam on bedrock, 101 ft. The Jackson Highway, extending from Chicago to New Orleans, and the Robert E. Lee Highway, from the Eastern seaboard to the Pacific Coast, will cross over the top—about 125 ft. from the river-bed.

Boat channel and locks will be on the north side of the river—cut through solid limestone. The power house, for which the foundations have been drilled, will be at the south end of the dam. Total ultimate installation will generate 624,000 h. p.

More than \$15,000,000 of the \$106,000,000 spent at Muscle Shoals has gone into the construction of Wilson Dam. Government estimates are that it will require three years to complete it at a cost of \$7,500,000 each year. Ford engineers plan to complete it in two years at about one-third less cost.

be 1,184 ft. long, and will have 18 generating units, four of 30,000 h. p. each and 14 of 36,000 h. p. each.

While this construction is under way nearly 10,000 acres of land will have to be cleared and perfectly cleaned of its timber and made ready for the backwaters from the dam. The pressure pool to be formed will vary in width from a mile to three miles, and will be 15 miles long. It will forever obliterate Muscle Shoals, that for more than a century have been a baffling obstacle to navigation on the river.

When completed, the project will be a creation of remarkable beauty, as well as unmatched power. The smooth, glistening white dam and the giant concrete power house; the waterfall over the spillways for more than half a mile; the ornamental boulevard—a link in two great transcontinental highways at their intersection—crossing over the top; the blue, deep lake stretching in a magnificent crescent up the river for

15 miles, and the smaller lakes extending far out into the back country over tributary streams—these will make the initial operations at Muscle Shoals one of the show places of more modern and efficient America.

The great inter-connected Upper Dam is planned 15 miles east of Wilson Dam. This second project, that will be constructed very much on the order of Wilson Dam, with locks and power house, will be approximately 50 ft. high and a mile and a quarter long. Owing to the decreased fall of the river above the site, the Upper Dam

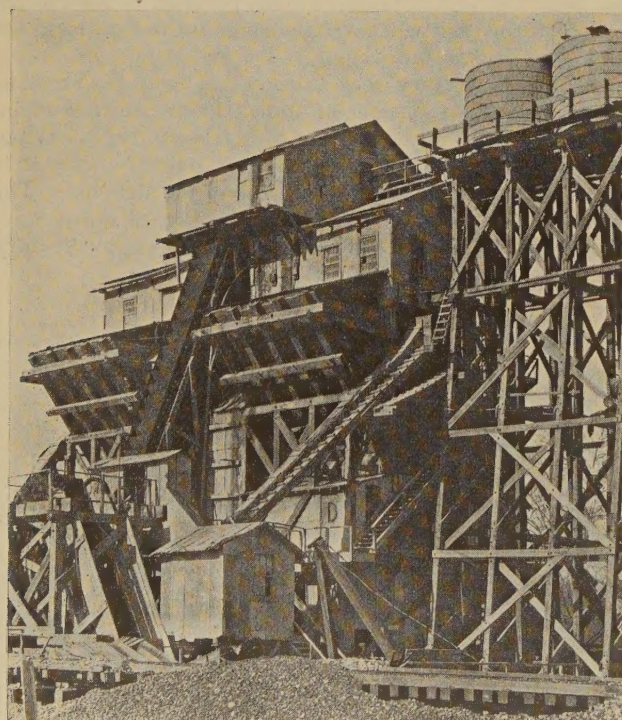


FIG. 2—CRUSHERS AND MIXERS ON ISLAND IN MIDDLE OF STREAM JUST BELOW WILSON DAM; SAID TO BE LARGEST PLANT IN WORLD—OPERATED BY ELECTRIC CURRENT FROM STEAM POWER PLANT AT GORGAS, ALABAMA

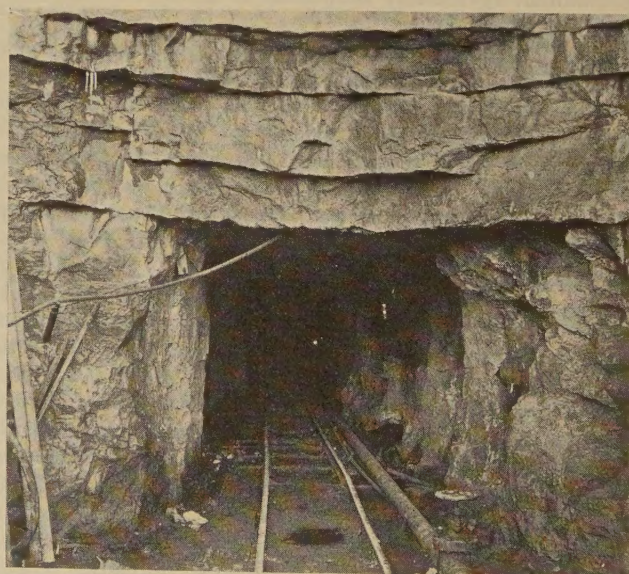


FIG. 3—TUNNELING THROUGH LIMESTONE ON SOUTH BANK OF RIVER—THESE EXCAVATIONS WILL BE FILLED WITH CONCRETE

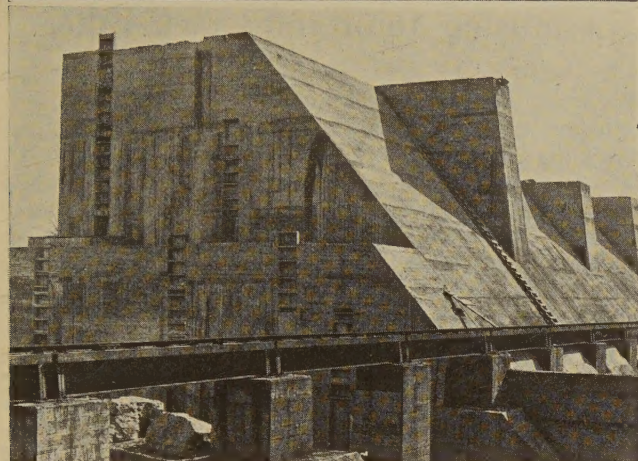
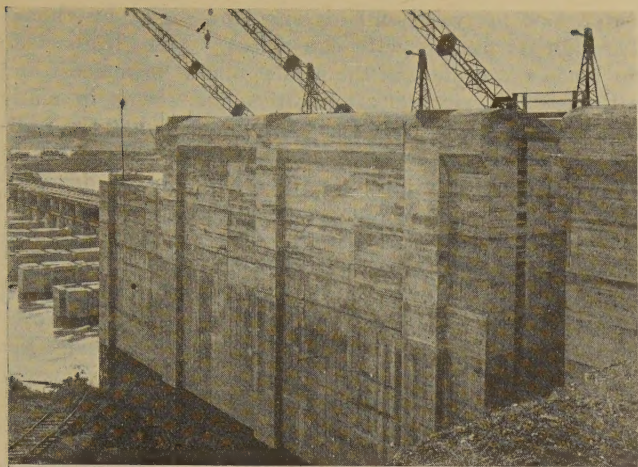


FIG. 4—NON-OVERFLOW SECTION OF WILSON DAM ON NORTH BANK OF RIVER

FIG. 5—SPILLWAYS IN COURSE OF CONSTRUCTION—NATURE OF THE WORK IS CLEARLY SHOWN HERE

will form a lake nearly 50 miles long. It will generate about 250,000 h. p. If the Ford offer is accepted by Congress, Mr. Ford will begin work on the Upper Dam simultaneously with Wilson Dam. Smaller, supplementing dams further up stream will bring the total horse power to over a million. This measure of hitherto un-attained coordinated power will be maintained by a narrow, but astonishingly high impounding dam in the watershed in eastern Tennessee. As an artificial power reserve, there is the 25,000 h. p. Gorgas steam plant and the giant steam plant right at Wilson Dam, that can deliver 100,000 h. p.

The significance of the project—especially under the Ford plans—is beyond belief of the casual observer. Here, to be turned directly to every-day uses, is a million horse power of energy in the center of a great producing population. It is in the heart of the South, at the entrance to the Central West, and not a difficult distance from the populous Eastern seaboard.

But the wondrous feature of the rivers' course is its proximity to the ores of electric utilization—and those ores suited to man's first needs. In the light of electrometallurgical discovery and experimentation, Muscle Shoals could not be more advantageously situated for utmost value and service to the American people.

The first function of the Shoals' energy will be the manufacture of cheap, high-content fertilizers. Just north of the Shoals, in middle Tennessee, are the worlds' second largest phosphate fields. And phosphoric acid, from phosphate rock, comprises the larger units in a complete plant food. Nature has deposited these seemingly

limitless supplies of blue and brown phosphate stone right on the borders of the valley, as if conscious that man would learn how to combine the transforming power of the stream, with the creative wealth in the rock. With nitrogen taken from the air and ammonia obtained through the processes, and with phosphate rock right at hand, fertilizers can be manufactured in larger quantities and cheaper in the Muscle Shoals region than in any other part of the world.

But—potash is needed also for some soils and some crops. Nature seems to have planned for this want also, because not many miles from the Tennessee Valley are the Georgia shales. From these potash can be obtained at comparatively low expense through the disintegrating heat of the electric furnace.

As for distribution, these fertilizers can be shipped at lowest cost and by tens of thousands of tons annually up and down almost the entire length of the Tennessee Valley, south on the Mississippi and north on the Mississippi to its limits of navigation, and north and northeast on the Ohio.

Increasing the food supply through the years without materially increasing the cost of production, is the most valuable service that can be performed by industry. And so Muscle Shoals, when in complete development as a producer and distributor of fertilizers in endless quanti-

Natural Resources Combinations of the Muscle Shoals Hydro-Electric District

MORE than 1,000,000 potential horse power of electric energy between Wilson Dam and the upper reaches of the Tennessee River.

Beside Wilson Dam—on the south side of the river—is the \$70,000,000 nitrate plant No. 2 for fixation of atmospheric nitrogen by the cyanamid process. Five miles below the dam is nitrate plant No. 1—the synthetic process for nitrogen fixation.

Directly north in Tennessee are the second largest phosphate rock fields in the world. Eastward in Georgia are potash shales. Nitrogen from the air and ammonia through the nitrate plant processes, phosphoric acid from the phosphate rock electrically treated, and potash from the shales through the electric furnace will make a complete fertilizer at exceedingly low cost and in immense bulk.

Bauxite from Georgia, Alabama and the new-found fields in northern Mississippi for manufacturing aluminum in great quantities through electrical smelting.

Red iron ore from the Birmingham district and brown ore from the Tennessee and Alabama fields, north and south of the river, for swift, cheap, electrical manufacture of steel.

Dolomite from Tennessee, combined through the furnaces with iron ore and bauxite, for both steel and aluminum alloys.

Coal for coke and briquet fuel from the Warrior Basin, 100 miles south—the richest coal fields in the South.

Cotton from the surrounding region for low-cost electrical manufacture of textiles of many descriptions.

For distribution in this country and for export Muscle Shoals and its coming industries are on the longest inland waterway system in the world.

ties, will take its place as the most important industrial and commercial achievement of this era.

Next to food comes raiment. And in the manufacture of cotton goods Muscle Shoals in time will expand into unmatched production. The staple from a large area can be shipped in at low cost for transportation. In fact, more than a million bales can be sent in annually, not a bale of which need be carried any considerable distance by rail.

Close in importance to sustenance and raiment are the utensils in which to prepare food. The most advanced progress in this field has been the perfection of aluminum receptacles. But, unfortunately, these are high in price. Here Muscle Shoals will come to the direct aid of the home women, who take pride in their cooking and house-keeping. Within less than 100 miles of the Shoals—in northern Mississippi—are bauxite supplies that may prove to be the most extensive yet discovered. With low-cost electric current from the Shoals, aluminum can be supplied to millions of American homes in quantities and at prices not previously realized.

Food, clothing, cooking vessels, shelter and fuel, are obviously five necessities in civilized existence. With the exception of houses, Muscle Shoals will have direct relation to all these. As to fuel, it, too, will come. South of the Shoals is the Warrior Basin, the South's finest coal fields. Hydro-electric current on the Tennessee, in conjunction with these coal deposits, will result in a briquet fuel to be distributed at lower prices per heat unit than either coal or coke now sell for.

As to steel and its products, and transportation, the red ores of the Birmingham district and the brown ores of Tennessee will become increasingly important factors—certainly so if Mr. Ford operates the project. These ores, in smelting and utilization through electric furnaces, will result in high grade steels manufactured cheap and rapidly.

But in the attainment of refinement and lightness, with strength, steel alone is not enough; there must be alloys. Tennessee holds the key material for these—dolomite, from which magnesium carbonate is obtained. With iron ore, bauxite, and dolomite in proximity to hydro-electric development on the river, Muscle Shoals will expand into a producer of steel rails; lighter, stronger, and more durable railway cars; alloy vehicle bodies and wheels, and lower-priced tractors, trucks and automobiles.

In short, from the project under full swing will come fertilizers to increase crop yields; more economical vehicles for travel and transportation; utensils in which to prepare foods for taste and need; fuel with which to cook it; and clothing for men, women and children. All will be at lowest possible prices, because of the perpetual, low-cost per kilowatt hour for current, and because this power is in the midst of the ores mentioned.

Such a mighty, comprehensive task—embracing several of the main necessities of life—has never before been attempted. To accomplish it will require the muscle of tens of thousands of workers; cash capital in huge sums; skill, talent and training of high order; and centralized and directing brains of unquestioned ability and unselfish aim.

As a practical and permanent inspiration, its value can hardly be over-estimated. It should, and probably will bring hydro-electric development wherever there are hills, mountains and valleys; wherever snow or rain falls or waters run to the sea. It is literally true that the small farmer, with only a ten or fifteen horse power creek on his place, can have his own little Muscle Shoals by means of a concrete dam, generator, water wheel and copper wires. At almost no cost after installation, he can make his miniature hydro-electric project pump

water, saw his wood, fill his silo and light his home. Through its use his wife can churn, sweep, iron, clean the home and even cook the meals; and at lower cost and with least physical effort. Cities and towns in many sections can likewise do for their people what the individual farmer does on the one hand and what Muscle Shoals accomplishes at the highest points of development. Business men and corporations, wherever they can obtain from 500 and 1,000 h. p. up, can establish industries and operate them continuously at least expense and at lowest cost for depreciation. Muscle Shoals, especially under Ford, means even more than the foremost project of its kind in the world. It means the true beginning of the hydro-electric age—on farms, in villages, for cities and for industry.

Disguising Joint and Crack Fillers

Unsightly black lines, sometimes jagged and irregular, which mar the appearance of practically all concrete roads, will be avoided by the use of a material recently developed by the Federal Bureau of Public Roads. This material has the same color as concrete and when used to fill cracks and joints the surface has the appearance of a continuous and unbroken slab. No particular advantage over other good materials is claimed for the preparation other than its color, and it is probable that the cost will be somewhat higher but not prohibitive.

The mixture consists of approximately 12 parts rosin, 1 part crude rubber, with sufficient barium sulphate to give the desired color. In preparation the rubber is dissolved in gasoline and the rosin is then mixed in with an application of heat, the coloring material being added as required. Any desired consistency can be obtained by varying the proportions. A material with remarkable adhesive properties is produced and which can be heated so that it will flow into the cracks and joints.

The German Concrete Association recently compiled data from 10 member firms on linings for concrete chimneys subjected to high temperatures. One firm held that a lining is necessary when the temperature exceeds 480 degrees, but most held that 570 degrees was the safe maximum, stating that the covering of soot which chimneys receive is sufficient protection at this temperature. One firm, with an extended experience on chimneys, gives the safe maximum as 660 degrees. Brickwork may be used up to about 750 degrees, while for higher temperatures, ranging up to 1,110 degrees, the lower part of the stack, up to a height of about 30 to 45 ft. from the bottom, should be protected by refractory material.—*Concrete and Constructional Engineering* (England).

On a recent job of the Ettinger Contracting Co., New York, the local topography made it possible to set up the mixer so that sand and gravel could be fed from truck to storage pile and to the mixer by gravity, but made it necessary to locate the cement house about 60 ft. away from the mixer. It was found impossible for one man to handle the cement under these conditions, so a gravity roller conveyor was installed, and the cement in 10-bag lots was rolled down on pallets to the mixer. One man had an easy time with this arrangement, also taking care of the empty bags. An additional advantage of this method was that the construction of the falsework for the conveyor was much more simple than it would have been for a wheelbarrow platform.—*Contractor's Atlas*.

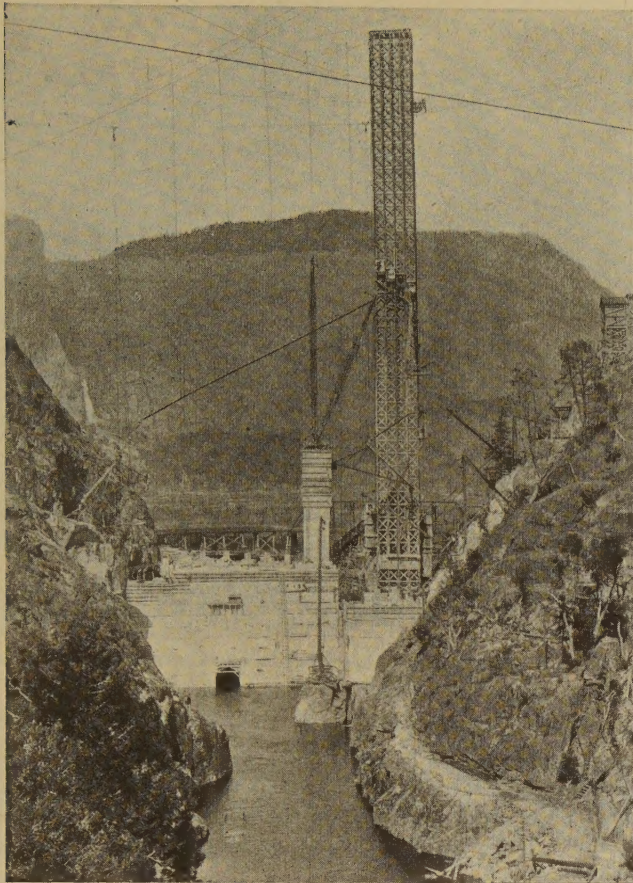


FIG. 1—HETCH HETCHY DAM AND TOWER LOOKING UP STREAM.

Unusual Plant Used in Hetch Hetchy Dam Construction

BY CHARLES W. GEIGER

Construction is now well advanced on the Hetch Hetchy dam of the new water and power development of the city of San Francisco.

The dam is to be of the gravity type arched in plan, with the radius of the up-stream face at the crest 700 ft. The principal dimensions are as follows:

	INITIAL	ULTIMATE
TOTAL length on crest, in feet.....	600	900
Height of crest above stream level, in feet.....	226	312
Depth from stream level to bed rock, at toe of dam, maximum in feet.....	101	101
Total height of dam, above bed-rock in feet.....	327	413
Width at top in feet.....	15	25
Width at base, maximum in feet.....	298	298
Volume of masonry in cu. yd.....	375,000	660,000

Most of the dam will be of 1:3:6 concrete embedded with large stones. For the concrete against the foundation, the cut-off trench, the upstream face, and the downstream face in the spillway section, a 1:2½:5 mixture is to be used to give greater impermeability.

A rock crushing plant to produce aggregate for concrete has been erected on the valley floor. The material, ranging from sand up to boulder and rock fragments about 1 cu. ft. in volume, is brought to the plant in trains of 4-yd. dump cars. It is passed over a grizzly with bars spaced six inches apart. The rock which does not fall through the grizzly is crushed by a 26 in. by 42 in. primary jaw crusher.

From this crusher a 30 in. belt conveyor carries the crusher run rock and the material that passes through the grizzly to a ¼ in. mesh revolving screen. The fine material or sand passing through this screen goes to a log washer, and the coarser material is run through a 2½ in. revolving screen, the rejects continuing to a No. 6 McCully gyratory crusher and a No. 49 gearless, belt driven Kennedy-Van Saun crusher, set for producing 2-in. rock. The recrushed rock is carried to a revolving ¼ in. manganese steel screen into which jets of water under high pressure are sprayed, separating all crusher dust and diverting it to the sand washer.

After the final crushing of the rock and washing of the sand, these materials are elevated on belt conveyors to a trestle 38 ft. high and discharged into storage piles, one for rock and one for sand under which are two trap tunnels with mining dump doors, spaced 14 ft. on centers. This storage has a capacity of 8,000 cu. yds. of sand and crushed rock. From the storage pile 4-yd. side dump cars are loaded with aggregates by gravity, the spacing of the trap doors permitting all the cars of a train to be loaded without moving the train.

The concrete mixing plant, with a capacity of 100 cu. yds. per hour, is located near the up stream face of the dam on the south abutment, at 3,540 elevation, 158 ft. above the lowest point in the foundation pit and 187 ft. below the crest of the dam.

This plant consists of two 2-yd. motor-driven Ransome mixers, with a charging bin of 300 cu. yd. capacity elevated above the mixers. The sand and rock brought in the dinky trains from the crusher plant are dumped into small receiving bins and elevated by motor driven belt conveyors to the charging bins. Immediately below the charging bin are measuring bins, with a fixed choke feed and inlet gates operated by hydraulic cylinders. The gates from the measuring bins are also operated by hydraulic cylinders, the mixer man manipulating a 3-way valve to move both gates. Adjacent to the receiving hoppers of the mixers are the cement measuring bins, which are filled from the weigher house, 180 ft. above, through two 8-in. riveted steel pipes. Water for the mixers is pumped from the river into a 10,000 gal. tank on the adjacent hillside and the quantity for each charge measured in a steel drum mounted on a mixer.

The spouting system is used for placing concrete. A four-compartment elevating tower, 10 ft. by 27 ft. in horizontal dimensions and 340 ft. high, has been built of Oregon pine timber. Each compartment is equipped with a self dumping 1-yd. steel skip. The skips are operated independently by single drum hoists driven

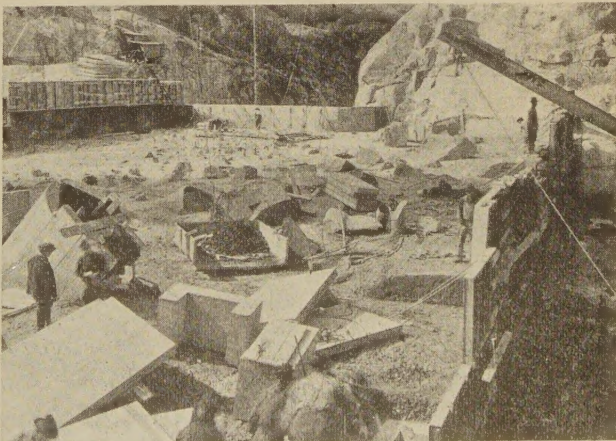


FIG. 2—HETCH HETCHY DAM—CLOSE VIEW OF CYCLOPEAN MASONRY.

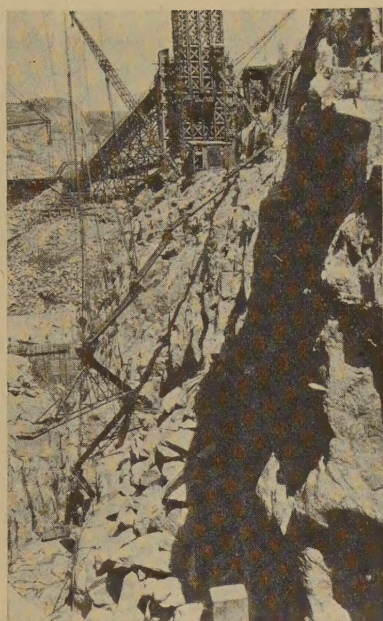


FIG. 3—GENERAL VIEW OF SOUTH SIDE AND BOTTOM OF DAM SITE, LOOKING UPSTREAM.

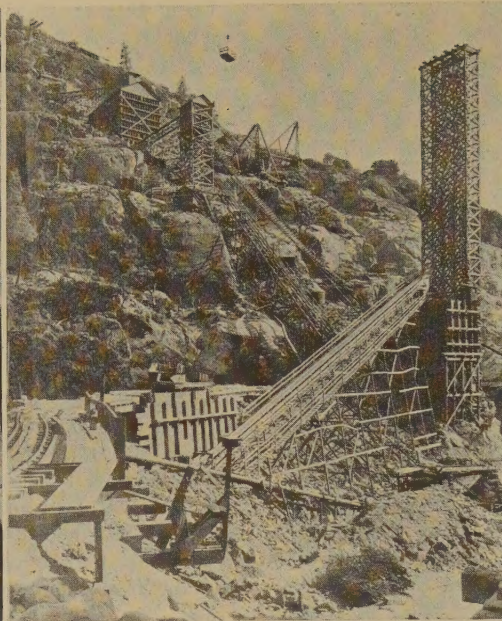


FIG. 4—CONCRETING PLANT.

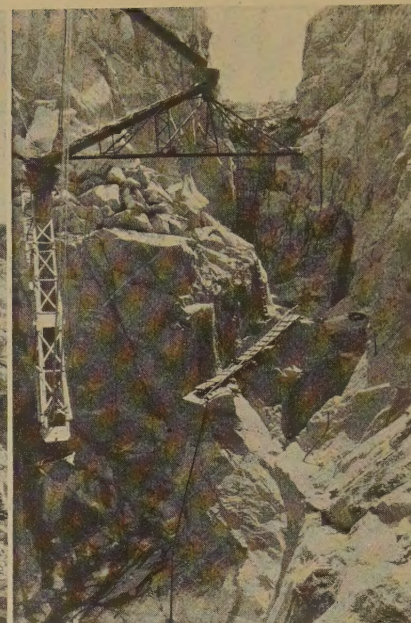


FIG. 5—BOTTOM OF FOUNDATION, LOOKING DOWNSTREAM.

by 75 h. p. motors and are capable of a speed of 300 ft. per minute. The tower is built up of four 10 in. by 12 in. and four 10 in. by 10 in. timbers, thoroughly sway-braced, and guyed with $\frac{3}{4}$ in. cables at every 40 ft. of its height. The concrete is distributed from the tower through two lines of 15 in. Insley chutes, with 50-ft. counter balance sections.

All cement except the relatively small quantity required for concrete blocks and miscellaneous small jobs, is delivered to the job in bulk. The box cars in which the cement is transported to the dam site over the Hetch Hetchy Railroad are emptied by means of an unloader consisting of a small motor driven winch which drags a flat board scraper. The cement falls from the car doorway into a hopper, from which a 12 in. screw conveyor takes it to a storage bin 150 ft. away, which bin is 60 ft. long, 32 ft. wide and 34 ft. deep, built with a V-shaped bottom, making the entire 13,000 barrel capacity live storage. From the bin a 12 in. screw conveyor 120 ft. long carries the cement to a weigher house. This conveyor runs through a 4 ft. by 6 ft. tunnel beneath the storage bin. Side trap doors are arranged along the sides of the tunnel to release the cement from the bin.

The weigher house is equipped with two 1,200 lb. capacity scales with automatic feed and cut off arrangements. Electrically operated signals, consisting of flash lights and horn sounders, and an independent telephone

line provide means of communication between the weigher house and the mixer house 180 ft. below. Two 8-in. steel pipes on a 1-to-1 slope carry the cement from the weigher house to the cement measuring bins near the mixers.

The work of the Hetch Hetchy Water Supply Department is being carried out under the direction of an engineering staff of which M. M. O'Shaughnessy, city engineer of San Francisco, is chief engineer, and N. A. Eckert is project engineer.

Studying Sewers in Los Angeles

As reported in a previous issue of CONCRETE, the United States Bureau of Standards has undertaken an investigation of the condition of sewer pipes in Los Angeles, for the purpose of studying the effects of sewage and sewer gases on clay and cement pipes, both of which now are being extensively used in that city. The program for the investigation involves excavation and inspection of sections of pipe from laterals in various parts of the city, and the replacement of these with tested pipe for future examination.

The major part of the work, however, consists in the installation of small sections of pipe in manholes in such a manner that a part of the specimens will be submerged in the sewage and a part exposed only to the action of sewer gases. The points at which exposure has been made have been selected in such a manner as to cover typical conditions throughout the system, and at these points periodic analyses of the sewage and gases will be made to determine the concentration of ingredients which may be injurious to pipes.

The object of the investigation is to determine by chemical survey general relations between rate or extent of deterioration of pipes and concentration of damaging elements in the sewage and gases. The problem is a difficult one, not only on account of the extent of the work involved, but more particularly because the field which it enters is as yet unexplored. For that reason, however, the report of this investigation is expected to be of value.

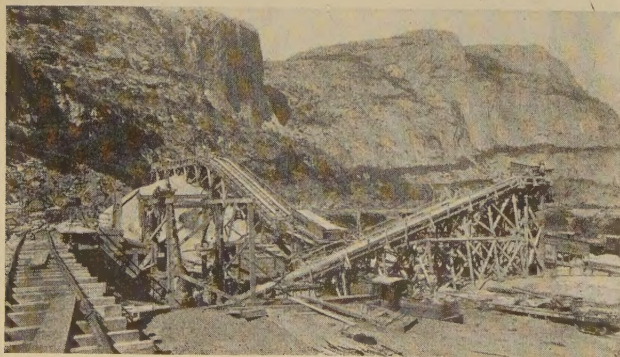


FIG. 6—CRUSHER PLANT AND ROCK AND SAND STORAGE PILES.

Rebuilding and Fireproofing Wrecked Elevator

BY GEORGE F. PAUL

The task of rebuilding the giant elevator of the Chicago & Northwestern Railway, South Chicago, Ill., wrecked by an explosion March 19, 1921, has presented many unusual problems. This elevator, with a capacity of ten million bushels, was constructed of reinforced concrete. So vast were the piles of debris, so numerous the engineering difficulties presented, so elaborate the plans for rendering the new structure explosion-proof, that even with the employment of the most modern methods and with the aid of a large force of workmen, the task of restoration seems slow.

Much time was spent in clearing away the debris. Locomotive cranes were employed to load the shattered blocks of concrete on flat cars. Workmen with acetylene burners cut free the bent and twisted steel bars.

The engineers made careful inspections to determine what parts were damaged by the explosion. One of the big jobs was to test the silo grain bins. For this purpose men were lowered in slings and they used heavy hammers to sound areas that appeared at all doubtful. It must be remembered that at the time of the fire some of these walls were subjected to an intense heat. The grain that filled some of the bins continued to burn for days. When cold water was turned on these intensely hot walls, even the best of construction was severely tested. Here the engineers had special problems to deal with.

Fig. 1 shows a view taken from the south side of the building, immediately after the explosion, and before any clearing of wreckage had been done at all. It will be noted that the structural steel marine tower, which was blown off its foundation by the force of the explosion and pushed into the river, stands in an upright position. The big pile of material immediately back of this tower in grain.

In cases where the ruptured surfaces had been subjected to compression in the original building, it was only necessary to fill the gaps with concrete, to resist the pressure. In most cases, however, the parts were subjected to a tensile stress. Then it was necessary to provide an overlapping of the new steel reinforcement with that of the parts left standing. Instead of drilling holes and inserting the ends of the reinforcing bars into the concrete still standing, enough of the concrete was cut away to lay bare more of the old reinforcing. Then new steel reinforcing was laid as in the original plan, the forms were built up and the concrete was poured. This method resulted in making the openings in the bin walls grain tight. A thin cement mixture has been used to improve the appearance of outside walls.

In the case of small cracks where the reinforcement has been sheared off, the plan has been to enlarge the narrow cracks with a chisel to a breadth of 6 or 7 inches, then fill with concrete. No special tamping has been required, as by having the filling opening at a higher level the concrete would readily find its way into the opening.

In rebuilding the walls of the cupola of the working house a change has been made—six-inch hollow tile has been used instead of concrete. Tile has also been used in rebuilding the track shed above the ground level. All

outside tile walls are to be given a coat of cement to make them watertight and uniform in appearance with the rest of the building.

In this work of restoration, most has been done on the working house as it was considered the building that could be first put to work handling grain. In its bins can be stored nearly a million bushels. This work has delayed the big task of rehabilitating the highly important river house.

Fig. 3 is another view of the southeast corner of the storage house, showing the new foundation concrete and the damaged bin walls cut away in readiness for the new work. The new marine tower is also erected and the steel work on the cupola of the river house is all completed, although as may be noted there is still a great deal of work to do on the bin wall itself.

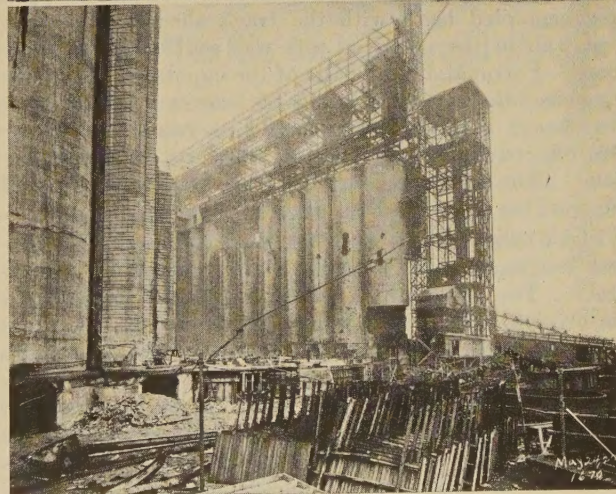
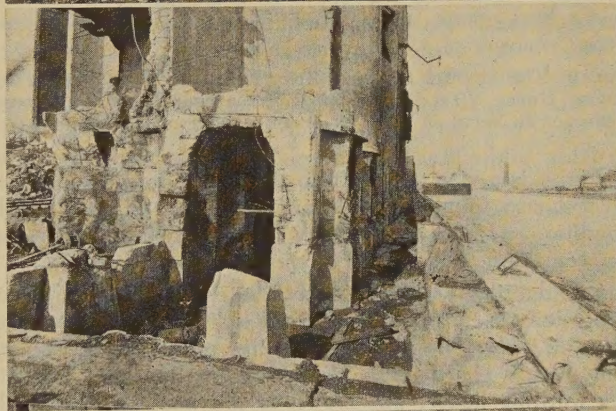
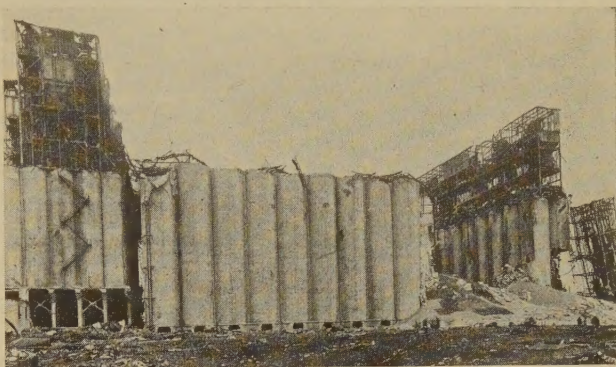


FIG. 1—VIEW IMMEDIATELY AFTER THE EXPLOSION THAT WRECKED THE CHICAGO & NORTHWESTERN ELEVATOR.

FIG. 2—SOUTH END OF RIVER HOUSE AND MARINE TOWER FOUNDATION AFTER WRECKAGE HAD BEEN CLEARED UP BUT BEFORE ANY REPAIR WORK HAD BEEN DONE.

FIG. 3—ANOTHER VIEW OF SOUTHEAST CORNER OF THE STORAGE HOUSE.

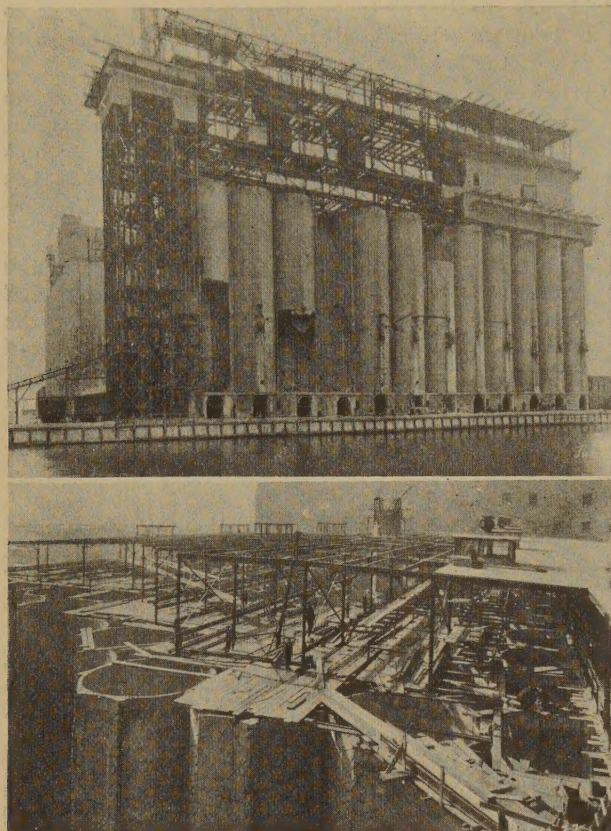


FIG. 4—RIVER HOUSE FOUNDATION REPAIRED AND PUT BACK IN GOOD CONDITION.

FIG. 5—TOP OF THE STORAGE BINS LOOKING WEST FROM THE RIVER HOUSE. THE EXPOSED REINFORCING SHOWN IN THE FOREGROUND WILL BE USED IN REBUILDING THE WRECKED BINS.

Fig. 4 is a view taken from the east side, showing the river house foundation repaired and put back in good condition. Immediately back of the marine tower can be seen the new bin walls at the southeast corner.

One detailed estimate places the damage done by the explosion at \$2,000,000, or 40% of the total value. It appears that the blast exerted its greatest force east and west. The drier house adjoining the west side of the working house, was blown to the west and dropped in a crumpled heap with the track shed. The heavy west wall of the receiving pits was shattered like cardboard. Fortunately the walls of the cupolas of the working house, the river house and the conveyor house above the storage bins were constructed of gunite and therefore offered little resistance to the force of the explosion. This vent saved much of the structural steel of the working house and the river house.

Fig. 6 is a view of the track shed foundation walls—that longitudinal wall having been replaced in its entirety. The end wall, in which cracks can be noted, is the original wall. This was found to be 15 inches out of plumb at the top after the explosion. However, with the aid of dead men and turnbuckles it was turned back into position and reused. This wall is 96 feet long, 16 feet high, 18 inches thick at the top and 30 inches thick at the bottom. The cracks in this wall were not as serious as the illustration would indicate, since the picture was taken after the cracks had been cleaned out for the purpose of patching.

Reinforced concrete cylindrical bins, 182 in number, formed the storage section of the elevator. These bins were 21 ft. 11 in. in diameter, inside measurement, and 105 ft. deep. Their walls, 7 inches thick, formed 143 interstice bins. This storage section covered a ground

space of 293 ft. by 181 ft. Each cylindrical bin would hold 32,000 bushels; each interstice bin, 8,000 bushels.

Although at the time of the explosion, many of the bins were full to the top, yet the northeast section of the storage house was lifted from its foundation and moved 3 inches to the east and 5 inches to the north. At the same time 34 of the bins at the southeast corner of the storage house were completely wrecked, the wheat pouring forth in a flood. Although the deep storage bins contained more than 5,000,000 bushels of grain at the time, the heavy concrete slab under them was lifted from the supporting pillars; at one point a steel bin spout was blown in between the slab and the pillars and crushed when the slab slipped back to place.

In repairing the cracks, a 1:2:4 mixture was used, with small gravel, smaller than one inch. In some places there were cracks that went part of the way through or all of the way through. These were plastered with a cement mortar, the same mixture as used in laying brick, which was applied with a trowel and then rubbed smooth with a damp brush. In case of broken interspace bins, forms are set up 6 feet high, then the form is poured, then another form is added, after which the lower form is raised to a new position and the work continued. By this method an average progress of 4 feet a day is made.

In many places the steel was broken off at the time of the explosion and it was impossible for the workmen to get a proper lap. In that case it was necessary to weld. Different positions of the rods were tried, but it was found that the results were most satisfactory when the weld was flatways, that is, when the rods were placed side by side with a 6-inch splice, there being a small space between. In this position the welder can look right down upon the work he is doing. Whenever there was a good projection, no welding was done, but the bars were lapped according to standard practice.

Many of the foundation walls were moved or broken. In such cases it was necessary to cut off portions of these walls so as to get the proper bearing for the bin bottom slab. The portion cut off was filled with concrete in the usual way. In some cases the whole wall was blown out.

There were many of the bins in which the hopper bottoms were shattered or injured. In bad cases entire replacement was necessary. In other instances, where the damage was not so great, the shattered portion was broken out and more reinforcing steel was inserted; haunches were built to act as beams for distributing the load on the replaced portions of the hoppers.

Many bins were so badly damaged that they are being entirely rebuilt. The work is naturally slow because of the necessity of tying the new bins securely to the portion of the structure that remained intact.

The tile used is smooth on the inside so as not to catch the dust; on the outside it is scored, and gunite readily adheres. The walls were made watertight with a coating $\frac{1}{2}$ to $\frac{3}{4}$ inch thick. Four cement guns were used in this operation.

Many difficulties have been encountered in the work of rebuilding. In the first place it was a dangerous job to approach some of the walls when it was difficult to determine just how much damage had been done. In many instances where the steel was distorted and the concrete cracked, there was no way to figure out the stresses. For that reason, those in charge of the work of reconstruction have felt obliged to observe a far greater factor of safety than would be required under most circumstances.

Special care has been taken in the electrical installation to make all connections, contacts, etc., dustproof.

Each panel box throughout the building has been located in a specially constructed dustproof room. All electric lights are equipped with vapor proof globes and guards.

The entire plant has been piped for compressed air, for use in blowing accumulated dust from motor bearings. In addition to the usual type of dust collecting system in connection with the cleaning machines, a vacuum system has been provided with which dust may be removed from floors, walls, ceilings and all exposed machinery and structural steel. This system is so designed that 16 men may be sweeping simultaneously in different parts of the plant. This is an entirely new feature in elevator construction and is the first case of such an installation. Vacuum producer units and all

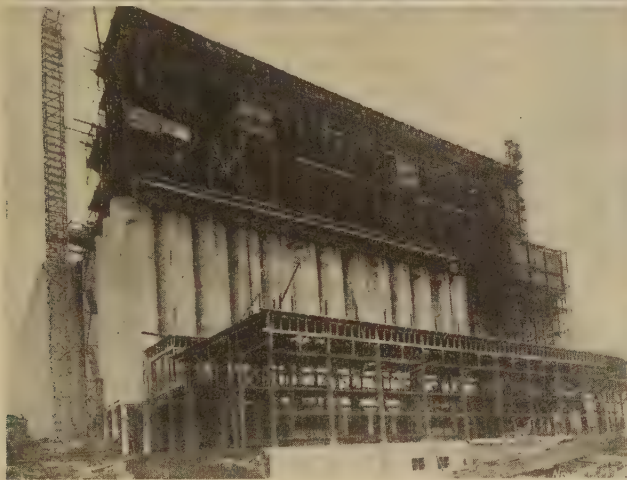
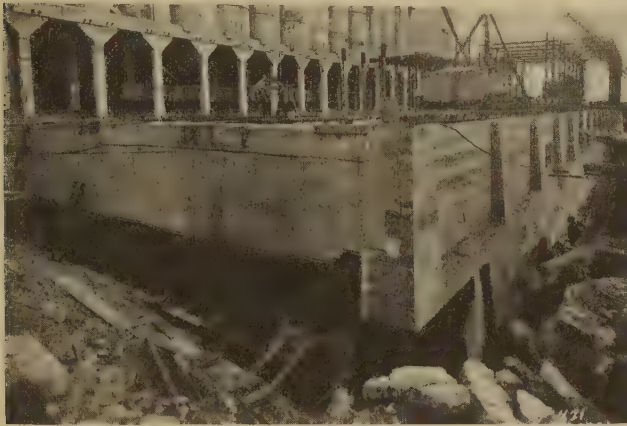


FIG. 6—TRACK SHED FOUNDATION WALLS—THE LONGITUDINAL WALL HAVING BEEN REPLACED IN ITS ENTIRETY.

FIG. 7—NEW TRACK SHED STEEL ERECTED AND THE COMMENCEMENT OF THE NEW STEEL WORK FOR THE DRIER HOUSE.

fans for dust collecting systems are located outside of the elevator proper in specially constructed buildings. Great care has been taken in the matter of ventilation. Many windows and ventilators have been located on the different roofs.

In the storage bin section, one interspace bin near the center has been converted into an air shaft to provide adequate ventilation for the basement. This has been arranged by extending the bin walls up through the cupola and above the roof for about 30 feet. A motor driven ventilating fan is located in the basement at the bottom of the shaft. Openings have been cut in all the basement walls and provided with shutters by means of which air currents in the basement can be regulated.

The entire elevator has been thoroughly equipped with fire extinguishers on every floor, in addition to which

there are hydrants and firehose located at convenient points throughout the entire plant.

John S. Metcalf & Company's engineers are in charge of the work of reconstruction, with the Witherspoon-Englar Co. as contractors. The work is being done under W. J. Towne, chief engineer, with B. M. Lockard as engineer for the Northwestern Railroad.

Modify Coal Priority Orders

The Associated General Contractors of America have filed a petition with the Interstate Commerce Commission asking modification of the Commission's priority order governing the distribution of cars for the transportation of coal. It is recognized, the petition sets forth, that the general welfare of the country will be promoted by giving preference to the transportation of fuel for the first four priority classes—that is for special emergencies, public utilities, etc., but to give the transportation of fuel for all other purposes a priority over the transportation of all other commodities, and especially construction materials, will not carry out the purpose of the Commission, it is asserted, and will disrupt business to the extent that it will work hardship far beyond the requirements for the transportation of fuel for a general purpose after the necessary emergency purposes are met. Employment of 2,800,000 workers is dependent upon uninterrupted continuance of the construction industry, and affects the lives of 11,000,000 people dependent for their daily support upon the wages of these workers in the entire construction field east of the Mississippi, where projects now in process of construction have a total value of \$1,700,000,000. The plea also is made that the construction program now going forward is largely directed to relieve the acute housing shortage, and to construct highways, making outlying districts accessible, which in turn has its effect on both housing and the cost of living. Stating that the construction industry is largely seasonal, the petition stated that to interrupt the program which is now at its peak, even for a few weeks, would cause such confusion as practically to throw over into another year many of the vital projects now under way, resulting in enormous losses. The petition was set for hearing August 25.

Future Traffic of Improved Roads

In building a road liberal allowance should be made for future increase in traffic, according to an advisory report issued by the United States Bureau of Public Roads. A traffic count conducted by the Bureau, in cooperation with state officials of Tennessee, on a number of roads in Davidson county, in which Nashville is located, revealed surprising facts when compared with a similar count in 1916.

During this period automobile registrations have doubled, while the number of motor vehicles on the road is five times as great as in 1916. In 1916 horse-drawn and motor vehicle traffic were almost equal in volume. In 1921 horse-drawn traffic had decreased only slightly in volume, and constituted 16% of the traffic, motor vehicles constituting 84%.

Observation by the United States Bureau of Public Roads in this and other counties led to the conclusion that volume of traffic may increase in much greater proportion than the number of motor vehicles and will also depend to a large degree on the condition of improvement of the road and on the economic conditions in the adjacent territory.

Prepared Portland Cement Stucco

In localities where there is sufficient demand for stucco a small mixing plant should prove a valuable addition to the business of material dealers or products manufacturers. The distinct advantage in the use of a prepared mixture of stucco, a mixture known to be satisfactory, and its convenient form, should create an added demand.

The drawback to such an enterprise is the impossibility of obtaining arbitrary or general formulas which solve the problems of mixture at long range. A thorough and expert analysis of the available materials is a solution of this difficulty, however. Manufacturers of white cement—the Atlas Portland Cement Co. and the Sandusky Cement Co.—have been particularly active in their study of stucco. The Sandusky company has made a study of the possibilities of plants of this nature and signified its willingness to investigate aggregates submitted.

The operation of stucco plants of this kind offers possibilities for substantial profit. Some of the larger cities already have these plants in operation. There is a substantial demand over all the country for these prepared mixes, and a real opportunity for those who desire to engage in this field. It is pointed out in details worked out by the Sandusky Cement Co. that the actual working details of such plants depend a great deal on local conditions. The operation, however, is not difficult. The aggregate must first be dried if it contains an appreciable amount of moisture. It is usual to store these materials individually before mixing—mixing and packing them as required. It is usually necessary to size the sand and stone before using. A. C. Newberry, of the Sandusky company, believes one mix sufficient for the base coat. He recommends 1 part of Medusa waterproofed gray cement, or gray cement containing 2% of Medusa waterproofing by weight, to 3 parts of clean, sharp sand which passes a No. 8 screen when dry. One pound of hair should be added to each sack of this mixture, in order to make it available for use on metal lath. Hydrated lime, to the extent of 10% by weight, or 1/5 the volume of the cement, should also be added.

Second, third or finish coat mixtures are frequently

desired in a cream color, which it is sometimes possible to obtain in a pale shade by the use of a buff-colored sand, although Mr. Newberry believes it is not commercially practicable to obtain cream-colored plaster coats without the addition of mortar colors. He has obtained excellent results with some colors manufactured by the E. M. and F. Waldo Co., New York City, containing kromestone raw sienna, their No. G7547. The amount of mortar color to be added will depend to some extent on the sand and the exact tint desired. This is but one of the many details which depend upon and must be varied to suit the material supply. Medusa waterproofed white cement should be used for the second and finish coats, which should be, as close as possible, the same—1 part cement to 2 parts of sand or fine aggregate, such as crushed marble, granite or other decorative aggregate. With some sand or aggregate it is feasible to use proportions of 1:2½. This detail again depends for good results on a careful study of local materials. For a standard mix finish coat it is advisable to use buff colored sand to reduce the amount of mortar color necessary. It is also well to have a dead-white mix, using white sand or aggregate. The appearance of the stucco is greatly improved by having sparkling aggregates, in order to relieve the dead-white background of the cement. The addition of a small amount of lampblack and black magnetic iron oxide mortar color coat will give a very pleasing silver-gray finish.

Illustrations show the layout of two plants for manufacturing these mixtures, which can also be used for mixing gypsum plasters, portland cement floor mixtures, gypsum plasters and cement-plaster mixtures. Some plants of this kind turn out as much as 50 different mixtures. A plant with a capacity of 10 tons is about the minimum size which will produce sufficient material to justify the expense of installation. A 75-ton plant is a size for large centers, where the demand is rather large. These plans were developed by the Sandusky Cement Co.

Fig. 1 shows the layout of a cement stucco plant with a capacity of ten tons of finished stucco per day. This plant can be operated by two men. It consists of a building 40 ft. long, 40 ft. wide, 15 ft. high, with shiplap siding and tar and gravel roof set on ground level, and concrete floor.

This plant requires the following equipment:

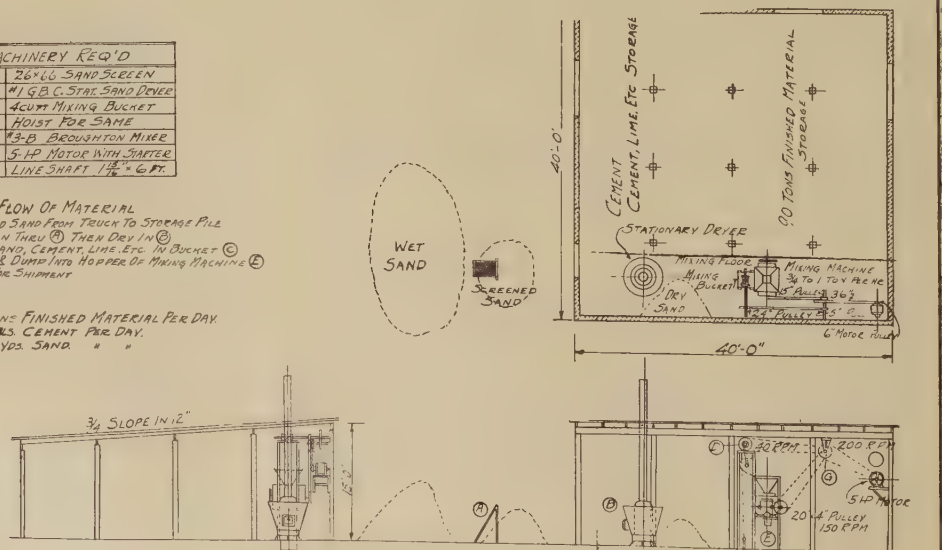
1	26 in. by 66 in. sand screen.....	\$	10.00
1	10-ton capacity stationary sand dryer.....		75.00*
1	Stationary dryer stack		5.00
1	4 cu. ft. mixing bucket.....		35.00

FIG. 1—LAYOUT OF 10-TON STUCCO CAPACITY MIXING PLANT

MACHINERY REQ'D	
A	1 26" x 66" SAND SCREEN
B	1 10 TON C. STATIONARY SAND DRYER
C	1 4 CU. FT. MIXING BUCKET
D	1 HOIST FOR SAME
E	1 1/2 HP. BROUGHTON MIXER
F	1 5 HP. MOTOR WITH STARTER
G	1 LINE SHAFT 1 1/2" x 6 FT.

FLOW OF MATERIAL
UNLOAD SAND FROM TRUCK TO STORAGE PILE
SCREEN THRU (A) THEN DRY IN (B)
MIX SAND, CEMENT, LIME, ETC. IN BUCKET (C)
HOIST & DUMP INTO HOPPER OF MIXING MACHINE (E)
BAG FOR SHIPMENT

10-TONS FINISHED MATERIAL PER DAY
20 BAGS CEMENT PER DAY
4 CU. YDS. SAND " "



1	drum hoist for same	60.00*
1	Frame for same	35.00
1	3B Broughton mixer	300.00*
	Erecting mixer	60.00
1	Line shaft	35.00
	Belting	20.00
1	5 h. p. at 1,200 r. p. m. 60 cycle 3-phase 440 volt motor, with starter	180.00*
1	Bracket to hold same	10.00
	Wiring	50.00
	Incidentals	250.00
	Building 1,600 sq. ft. at \$1.00 per sq. ft.	1,600.00
		<u>\$2,675.00</u>

*F. O. B. factory.

In operating this plant the wet sand is dumped from trucks on outside storage pile, taken from this pile, hand screened, wheeled into building and placed in dryer. The dry sand is measured into the mixing bucket, proper amount of cement, lime and other ingredients added to bucket, then hoisted up and dumped into hopper of mixing machine. When properly mixed it is drawn off into bags for shipment.

Fig. 2 shows a layout of a cement stucco plant with a capacity of 40 tons to 75 tons of finished stucco per day. This plant is machine operated. It consists of a building 80 ft. long, 44 ft. wide and 20 ft. high. A concrete block or stucco building, with concrete floor set at car door level, approximately 4 ft. above ground level, is recommended. Warehouse storage of materials is not provided for in this building.

This plant requires the following equipment, prices estimated f. o. b. factory:

1	16 ft. inclined elevator, with 6 in. by 4 in. buckets....	\$ 250.00*
1	Furnace for rotary dryer	400.00*
1	36 in. by 20 ft. rotary dryer.....	900.00
1	Foundation and erecting dryer.....	150.00*
1	225 and hood for dryer	250.00*
1	20 ft. elevator, with 6 in. by 4 in. buckets.....	225.00
1	Wooden casing and erecting	100.00*
1	24 in. by 10 ft. rotary screen	860.00
	Erecting same	50.00*
1	Dry sand bin, 20 tons capacity	225.00*
2	4 ft. by 3 ft. measuring hopper	50.00*
1	4 ft. by 4 ft. mixing hopper	80.00*
1	20 ft. elevator, with 6 in. by 4 in. buckets.....	225.00
1	Wooden casing and erecting	100.00*
1	2A Broughton mixing machine	725.00
	Lineshaft, with pulleys, hangers, etc.	160.00*
	Erecting mixing machine	125.00
	Belting	100.00
2	10 h. p. at 1,200 r. p. m. 60 cycle 3-phase 440 volt motors, with starters	450.00
	Wiring	150.00
	Incidentals	500.00
	Building, 3,520 sq. ft. at \$2.50 per sq. ft.....	8,800.00
		\$14,325.00

*Erected.

September, 1922

In operating this plant the wet sand is unloaded from cars or trucks on outside storage pile. It is shoveled from this pile on an inclined elevator into a hopper feeding rotary dryer, from which the sand drops into an encased bucket elevator. This carries it up and dumps into a revolving screen, which separates the gravel and tailings and drops them into a chute, which piles them outside. The free sand drops into a storage bin. This bin can be divided into two compartments for two grades of sand, if desired.

The proper amount of sand is discharged from this bin into two measuring hoppers in front and below the bins; these hoppers are set so that they discharge the sand on the floor, so that it can be easily shoveled into the mixing hopper, where the cement, lime and other ingredients are added to make the proper mixture. This mixing hopper empties into an encased bucket elevator, which carries the mixture up and drops it into the hopper of the mixing machine. When properly mixed, the finished product is released into lower section and drawn off into bags for shipment.

Would Improve Roof Flashing Details

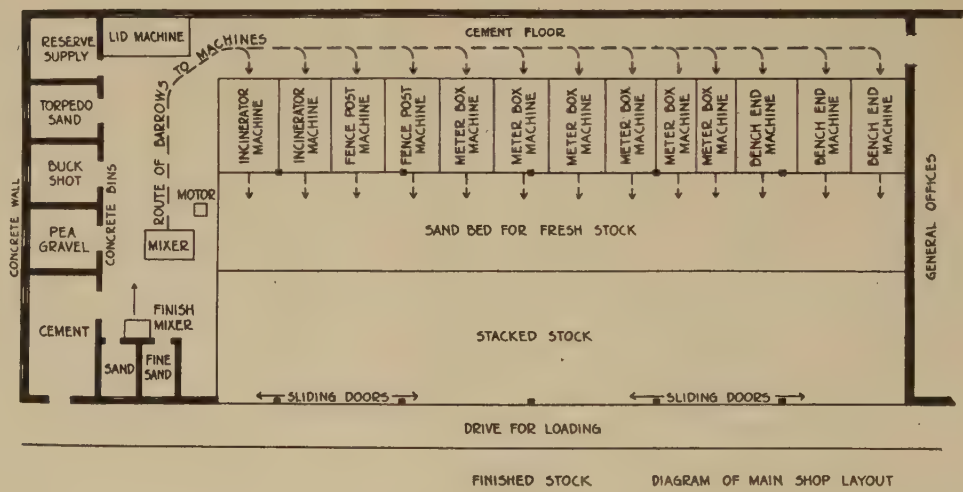
William A. Parfitt, of Parfit Bros., of 26 Court street, Brooklyn, N. Y., calls attention to roof flashing details, page 50, CONCRETE for August:

"I would call your attention to the last two items, where pipes pass through the cement arches. The flashing should be collar flashings, with flanges and made entirely free from the pipes, and in case of floors the collars should extend at least 2 in. above the floor surface to prevent water from following down the pipe, and for roofs at least 6 to 8 in. and cap flashed, which cap flashing should be a part of the pipe joint. The unequal expansion of the piping system would be taken care of without destruction to the flashing or arch.



FIG. 1—VIEW OF THE STREET FRONT OF PLANT

FIG. 2—DIAGRAM PLANT LAYOUT



FINISHED STOCK DIAGRAM OF MAIN SHOP LAYOUT

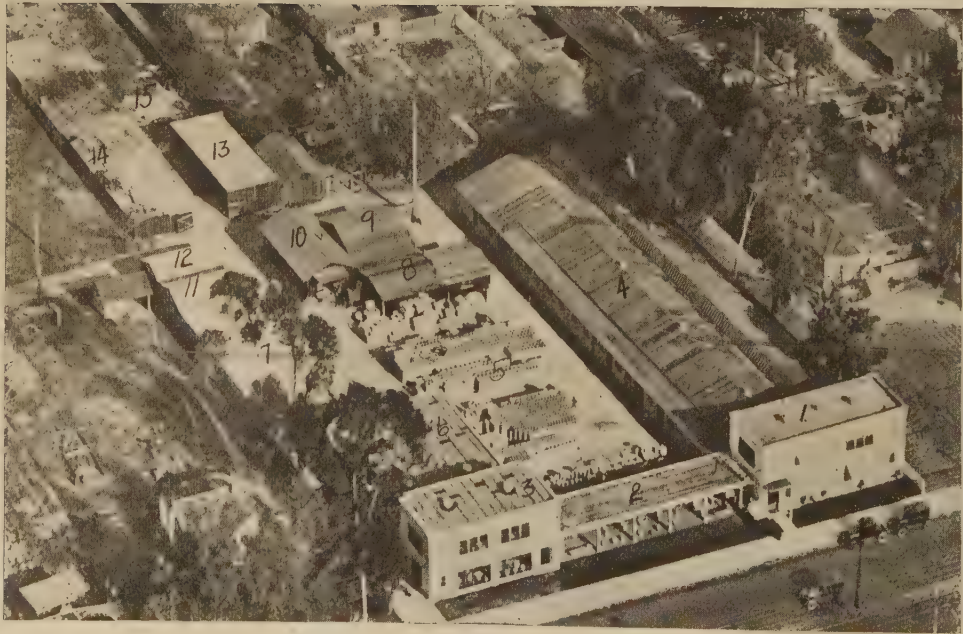


FIG. 3—AIRPLANE VIEW OF PLANT LAYOUT

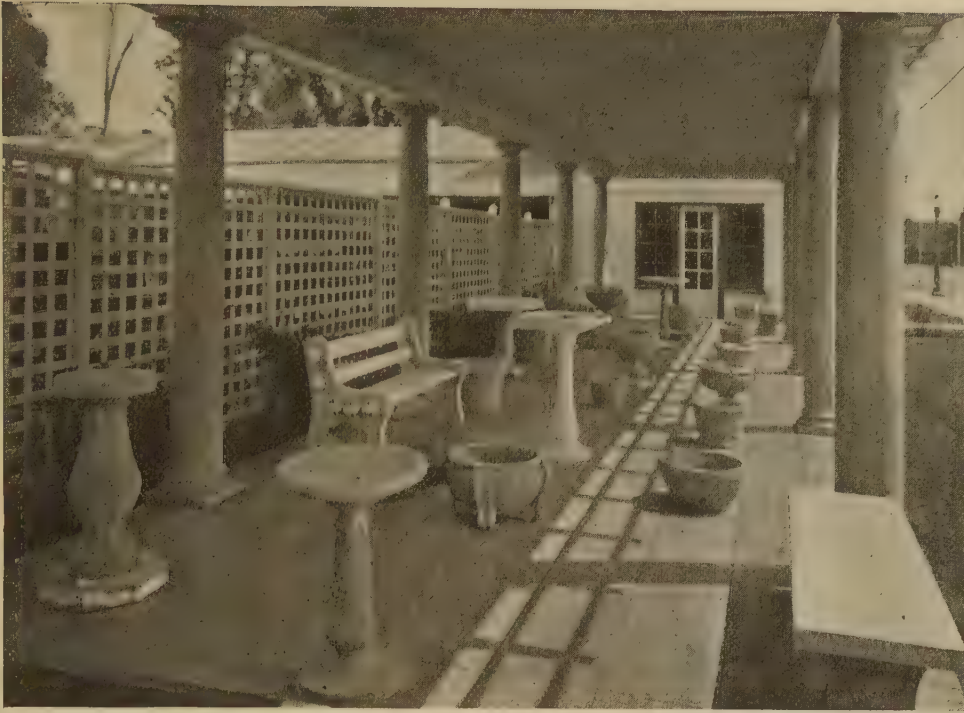


FIG. 4—A CLOSE-UP OF THE DISPLAY PERGOLA, WHICH ON A MAIN TRAVELED THOROUGHFARE IS A GOOD ADVERTISING MEDIUM

A Big Business in Concrete Specialties

The business of the Art Concrete Works, using an acre of ground with an attractive display frontage, in the heart of the industrial section of Pasadena, Cal., is a striking example of successful development of concrete products specialties.

The business, at first an industrial venture of Leo G. Haase, was founded in Chicago in 1885, moving to Pasadena in 1910, where it has continued to broaden its line and increase its output over a considerable territory. The business includes garden furniture, park benches, lighting standards, water meter boxes, and numerous other products based on 30 patents by which the com-

pany has maintained the originality and exclusiveness of its line.

The experience of the company has proved the importance of quality in the manufacture of concrete products. In all its products the company sticks to one proportion of mix (1:3), in both commercial and ornamental lines, even though such adherence to one standard mix is not necessary, perhaps not always desirable for the best results, it is a commendable error. For fine textures in gardenware and art stone trim, white cement is used, even at a delivered cost about double that of the eastern price. A particularly striking black

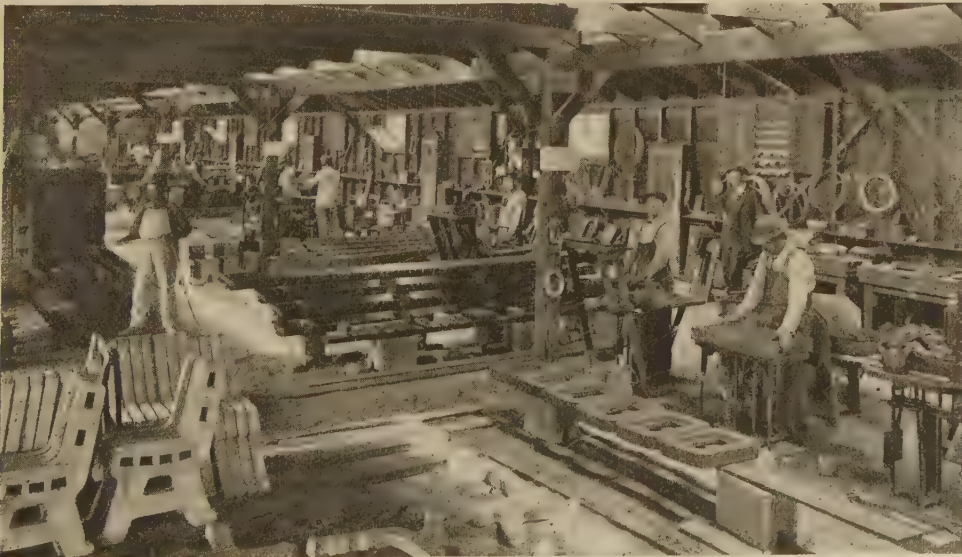


FIG. 5—INTERIOR OF PLANT—REFER TO FIG. 2

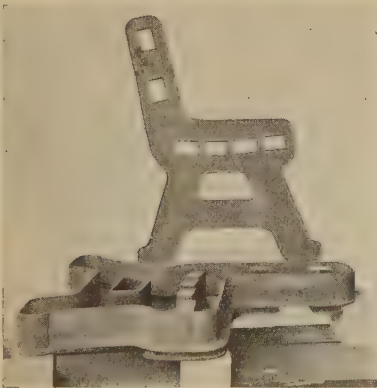


FIG. 6—STORAGE YARD

granite aggregate, not found in the east, is used in ornamental work. All units, even the flower pots, are reinforced. Waterproofing is used on some work. Sub-



FIG. 7—CONCRETE GARDEN BENCHES AND A METAL MOLD FOR BENCH ENDS



stantial iron tables permit proper tamping. When completed, the units are carefully cured in sand beds to prevent crazing. In designing, care is taken to select only light and graceful models. Sharp corners are avoided, every corner and edge being rounded or beveled, if possible. The practical features, as well as the ornamental, are kept in mind.

At first, concrete pipe, land markers, catch-basin covers, and hydrant boxes were manufactured. In localizing the products, a real opportunity was seen in manufacturing water meter boxes, which in California are placed close to the surface outside the dwelling. These

boxes (Fig. 8) have formed the staple line of the company. The trade name is "Safti-posit." The line now includes 10 different types and sizes, sold in 265 cities and towns from New Mexico, through Arizona, California, Oregon and Washington to the Canadian border. Quantity production and a carefully designed and managed plant have resulted in costs which permit a surprisingly low selling price for a high grade product.

Fig. 7 shows the "California bench," the next specialty to be introduced. This bench is popular in California and has been introduced in the east to a limited extent through the interest of winter visitors.

Another specialty adapted for quantity production is the sectional reinforced incinerator or rubbish burner (Fig. 9). Built up in 2, 3, or 4 tiers of interchangeable reinforced slabs, keyed or hinged at the corners by steel rods, they give a flexible construction permitting expansion and contraction without cracking. This incinerator can be shipped knocked down and is readily assembled. It is salable in localities where householders are required to burn their rubbish. It is superior to wire mesh or boiler plate burners.

A third "Safti-posit" specialty is the channel fence post stub or base, made in three sizes, to receive 2, 3, and 4 in. wooden posts.

This company was one of the first to manufacture concrete lighting standards, some of which were used on the streets and parks of Pasadena as early as 1911.

Two years ago a complete line of ornamental pots, vases and garden furniture was added under the trade name of "Brookstone." At first plaster molds were used for these units, but as they proved unsatisfactory in many respects, and as the more desirable designs were determined, metal molds were substituted. Aluminum molds have been found satisfactory, being light and easy to handle, with a smooth surface that draws readily. Iron, wood and sheet metal molds, however, are also satisfactory for many types.

These designs and the molds for making them, as well as special machinery, are covered by 30 patents which the company holds. The plant is now equipped to turn out molds for sale to other manufacturers of concrete products.

The plant itself, convenient to both the Santa Fe and Southern Pacific railways, is on the main thoroughfare between Pasadena and Los Angeles, and less than 10 miles from the latter city. To obtain the full advertising value of this location, care has been taken to design

attractive buildings and to provide an artistic setting for the samples of gardenware and other ornamental pieces.

Fig. 1 shows the front on Fair Oaks avenue, from left to right, sales room, pergola show room for garden furniture, and offices. Over the salesroom is the drafting room and model storage room, where the valuable master patterns are kept. The offices occupy the entire building at the right of the pergola.

An airplane view (Fig. 3) shows the general arrangement. Referring to the numbers, the different depart-

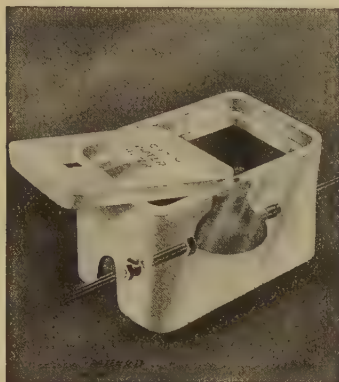


FIG. 8—CONCRETE WATER METER BOX

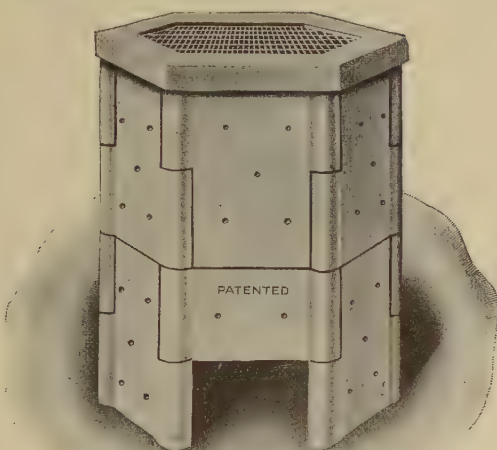


FIG. 9—FABRICATED CONCRETE REFUSE BURNER

ments are as follows: (1) Offices, (2) pergola show room, (3) salesroom, drafting room and model room, (4) main shop (commercial products), (5) storage yard, (6) art shop (gardenware, etc.), (7) molds and patterns, (8) crate shop, (9) reinforcing shop, (10) machine shop, (11) pattern shop, (12) plaster modelling room, (13) garages, (14) sand drying platforms and screens, (15) surplus stock yard.

Particular care has been taken in designing the main shop to provide the most direct and convenient routing of materials to the mixer and from the mixer to the different machines. The finished products go direct to the sand beds opposite the various machines, and from the sand beds straight to the storage yard. Fig. 2 indicates this arrangement clearly, and Fig. 5 gives a partial view of this shop.

The manufacture of garden furniture and other art work is entirely separated from the commercial work, having its own mixer, so that special aggregates can be used. The arrangement of the plant permits expansion and practical duplication when required, on land



FIG. 10—SOME OF THE ORNAMENTAL PRODUCTS

on the opposite side of the alley, owned by the company, and it seems likely that such duplication will soon be necessary. Other lines are in preparation and nearly ready for the market, and the business in the sale of molds and equipment is rapidly expanding.

The number employed in the building trades in the United States increased 150,000 in the past decade. According to an announcement by the Department of Commerce, the total enumerated in the fourteenth decennial census, taken as of January 1, 1920, was 1,878,725, as against 1,722,836 in 1910. These totals include all persons, 10 years of age and over, who could be classified definitely as employed in specific building trades. They do not include, however, considerable numbers of persons who, according to the census returns, were employed as laborers on buildings, general laborers, etc., or as helpers, apprentices, or semi-skilled operators in building and hand trades.

The total for 1910 includes 731 women, of whom 408 are employed as paper hangers, 171 as carpenters, and 103 as painters, glaziers, or varnishers. The 1920 total included 1,352 women, of whom 797 were employed as paper hangers and 381 as painters, glaziers, or varnishers.

The largest class of building workers is made up of carpenters, who numbered 887,379, or nearly half the total in 1920. Next in order of numerical importance were the painters, glaziers, and varnishers, 248,497; the electricians, 212,964; the plumbers and gas and steam fitters, 206,718; and the brick and stone masons, 131,264.

Of the total building workers covered by the census classification for 1920, 47,264 were from 17 to 19 years of age, inclusive; 179,064 from 20 to 24 years; 956,765 or more than half the total, from 25 to 44; 590,901, or nearly one-third of the total, from 45 to 64; and 102,128 were 65 years and over; for 2,603 the age was not reported.



FIG. 1—ONE WING OF THE SAMARKAND HOTEL, SANTA BARBARA, CAL.—HOLLOW CONCRETE TILE MADE ON LAC-TILE MACHINE, SUPPLIED THE WALL STRUCTURE

Building Unit Progress in Southern California

A letter from M. G. Watkins, president of the Los Angeles Concrete Tile Co., with plants at Los Angeles, Alhambra and Monterey Park, producing Lac-Tile, is particularly interesting because it records not only the active progress of one manufacturer, but also because it reports the progress of concrete building units by broad cooperative effort and constant advertising.

Mr. Watkins was elected president of the Concrete Products Association of Southern California; R. E. Johnston, general manager of the Concrete Building Tile Co., of Glendale, manufacturers of hollow building tile and concrete brick, was elected vice-president; and R. H. Hubbard, concrete products representative of the Los Angeles branch of the Portland Cement Association, secretary-treasurer. Four alternate vice-presidents were elected to serve as chairmen of committees representing the various branches of concrete products manufacture, as follows: E. J. Pennypacker, Concrete Lumber Co., of Los Angeles; W. L. Jencks, Jencks Brick Company, of Los Angeles; F. C. Stenzel, Stenzel & Krebs Stone Co., of Los Angeles; and F. X. Enderb, manufacturer of concrete flue vents and burial vaults.

The purpose of the association is to establish a definite and standard quality in the manufacture of all concrete products, which includes building units, architectural stone, art concrete, concrete hollow tile, concrete blocks and concrete bricks, and to give the consumer a finished product that will continue to live up to the slogan of "concrete for permanence."

"We have accepted as a standard the American Concrete Institute specifications, which are now the basis of building codes in most American cities," says Mr. Watkins. "In addition, the Association intends to give immediate attention to building code and adjustment



LAC-TILE

The modern concrete hollow building tile conforms to all the requirements of the building code.

\$1.75 will buy enough Lac-Tile for the average five room house.

Lac-Tile is heartily endorsed by Architects, Builders and Contractors; even the owners consider Lac-Tile the modern building necessity.

Investigate before you decide on the material for your next building. It will pay you to send for the interesting booklet—it's yours free.

Los Angeles Concrete Tile Company

Concrete Products

Drain Tile—Hollow Building Tile—Roofing Tile

Russell Ave. and Peach St., Monterey Park,

Alhambra, Calif.

Phone Alhambra 1182-W

FIG. 2—SAMPLE NEWSPAPER ADVERTISEMENT OF LAC-TILE

and all other things of direct interest to the local manufacturers and those who use concrete products."

Mr. Watkins' letter to CONCRETE is in part as follows:

Briefly, the situation in this section of the country is that concrete products have been in bad favor. Many so-called manufacturers have come and gone, leaving a "bad taste" over the entire field. Our own company had this situation to face, almost alone, when we began operations in April of 1921, and we spent thousands of dollars in newspaper advertising, booklets, and general publicity. With the cooperation of the local office of the Portland Cement Association, we knocked out antique building codes in several surrounding



FIG. 3—ANOTHER SAMPLE OF LAC-TILE CONSTRUCTION—
THE ROOF IS ALSO OF CONCRETE TILE

cities, and soon hope to have radical changes made in the Los Angeles code.

The measure of our success, individually, can best be judged by the fact that our factories at this time are barely able to take care of 25% of the business coming in on Lac-Tile. It shows that our organization has laid a solid foundation, and now, that there are other manufacturers coming into the field, the ice is well broken, and their battles will not be so hard to fight.

Our new association has about thirty members, representing almost a dozen plants. We are meeting, temporarily, at the offices of the Portland Cement Association, 546 South Spring St., the first Friday after the first Monday in each month. We propose soon to have a monthly dinner with regular speakers and we invite all authorities on concrete, who happen to be traveling through, or visiting in this territory to speak before our organization. We have adopted the American Concrete Institute Specification No. 10 as standard for building units and are now seeking all information possible in order to adopt standards for the various other products made of concrete.

We have pledged our support to the building departments of this and other cities in running down irresponsible culprits who persist in attempting to flood the market with low grade concrete products and mislead the unsuspecting public.

A visit to the office of C. V. Welsh, chief deputy building commissioner, of Los Angeles, where examination may be had of all sorts of so-called concrete products, is enough to give a distinct shock to any individual having even but little conscience left, and to those who are striving to be 100% honest in their manufactures it is almost enough to discourage any attempt to compete with such business.

We have the word of Mr. Welch that he will prosecute any case brought to his attention where such inferior concrete is being used in the city. This is one step in the way of protection, and has served also to give his department at least a little confidence in us—this after having acquainted him with our aims in standardization, and our eagerness to cooperate with and assist him.

While the building code of this city does not permit buildings of more than one and one-half stories in height to be built of concrete units passing city specification, we recently took samples of Lac-Tile to him and secured his whole-hearted cooperation in getting for us a permit from the Department of Public Works for the construction of a two-story, four-flat building in one of the better class residential sections of Los Angeles.

Our association is planning to advertise extensively throughout our territory in the newspapers and building trades papers. A systematized educational campaign will be carried on in such way as to be of benefit to manufacturers of every style of concrete products made in Southern California. We have arranged our dues on the basis of volume of business done by each company, calculated on gross cash income, the smallest amount being \$10.00 per month based on an annual gross income of ten thousand dollars a year or less, and the highest \$35.00 per month, based on an annual gross income of more than \$60,000 per year.

Lac-Tile is made in these sizes: $3\frac{7}{8} \times 5 \times 12$; $5\frac{7}{8} \times 5 \times 11\frac{5}{8}$; $7\frac{7}{8} \times 5 \times 11\frac{5}{8}$; $5\frac{7}{8} \times 5 \times 6$; $7\frac{7}{8} \times 5 \times 6$.

It is produced on a machine that makes use of sudden impact—a trip hammer blow of 14 tons—in compacting the product.

September, 1922

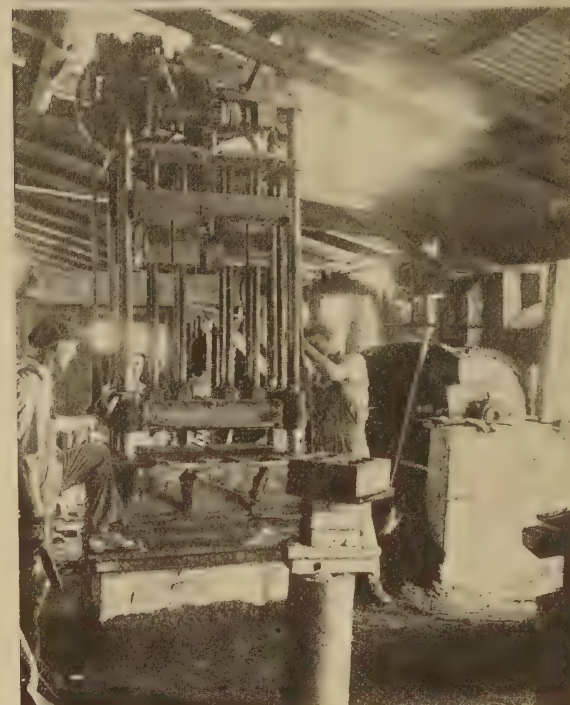


FIG. 4—THIS IS LAC-TILE

FIG. 5—THE LAC-TILE MACHINE

Largest Concrete Ship in European Waters

The largest reinforced concrete ship in European waters was recently launched successfully by the Italian Reinforced Concrete Ship Co., Ltd., at Lavagna, Italy, according to a report from Vice-Consul Ilo C. Funk, at Genoa. The vessel is constructed entirely of reinforced concrete, with a gross tonnage of 4,700 and a net tonnage of 3,000 tons. The vessel was christened the *Perseveranza*. It is equipped with two motors giving an average speed of 8 miles per hour, and also has rigging for five sails, which may be used for auxiliary power. It is equipped as a pile boat, and is the only one of this type of construction. The construction of the vessel was observed closely by the Italian mercantile marine.

Estimating Building Excavation Costs¹

By CHARLES F. DINGMAN, M. Am. Soc. C. E.

Because of the apparent simplicity of the operation of excavating in most building construction, it is not usual to give as much consideration to estimating the cost as the importance of this item would warrant.

There are so many factors which affect the cost of excavation that it is really one of the most difficult parts of building work to estimate accurately.

Computing the quantity of material to be excavated is a comparatively simple matter, but consideration must be given to all of the following factors:

Care must be taken to include the dimension from outside to outside of the spread of footings, and also from the top of the grade to the underside of the cellar floor construction. Footing trenches, pier-holes and other excavations extending below the general cellar excavation should be figured separately, under proper headings, and individual prices computed for each class of excavation.

Where the nature of the soil is such that the banks will not retain their vertical position without support, proper allowance must be made for bracing. With shallow excavations, or where building lines or other constructions do not interfere, it will usually be found cheaper to slope the banks than to brace them. A discussion of the cost of bracing will be given further on.

If the banks are to be sloped it will be necessary to figure the cost of excavating a prism of earth all around the excavation, the dimensions of the prism being determined by the depth of the excavation and the angle of repose of the material to be excavated. The volume of this prism will also have to be added to the quantity of backfilling.

The angle of repose, or the slope which the material will maintain without further sliding, is approximately as follows:

	Wet	Dry
Sand	3 degrees	33 degrees
Loam	27 degrees	35 degrees
Clay	17 degrees	45 degrees

These figures are, of course, subject to as wide a variation as there are variations in the soil formation at different places. Determination of the angle for any particular kind of earth can only be made by observation, and the estimator will usually make it his business to be sufficiently conversant with the soils in his vicinity to approximate the angle of repose in any instance, or he will be able to get that information from some one who is familiar with local conditions.

In fairly firm soils, footing and pier excavations can usually be figured as the net width of the bottom course, without allowance for forms, but sufficient space must be allowed for footing forms in unstable soils and for wall or pier forms in all cases where they will be used. This allowance is usually taken as one foot from the face of the wall.

Where the area to be excavated is comparatively small and the depth of the cut is not over 9 or 10 ft., the shoveling will usually be done entirely by hand, and the following figures represent the amount of earth that can be loosened and shoveled out per man per hour:

	Dry	Wet
Sand or loam.....	1.12 cu. yds.	0.70 cu. yd.
Ordinary medium soil.....	0.70 cu. yd.	0.40 cu. yd.
Heavy soil or clay.....	0.45 cu. yd.	0.30 cu. yd.
Hard pan	0.40 cu. yd.	0.25 cu. yd.

In very shallow footing trenches the production will vary but slightly from the figures given above, but for deeper trenches and for deep and narrow pier pits the production will only equal the following percentages of those quantities:

	Trenches	Pier Pits
Depth not over 6 ft.....	77%	73%
Depth 6 to 10 ft.....	48%	45%
Depth 10 to 14 ft.....	33%	30%

Where the area to be excavated is comparatively large, it will usually be found economical to use a plow to loosen up the earth and prepare it for the shovelers, though they will occasionally have to do some small amount of additional picking.

One plow, drawn by two horses, driven by one man, with one helper, can loosen

35 cu. yds. of ordinary medium soil per hour;

20 cu. yds. of heavy soil or clay per hour;

or, with an extra driver and pair of horses,
20 cu. yds. of very tough clay per hour.

When the earth has been broken by the plow, the shovelers should average the following production:

Ordinary medium soil.....	1.22 cu. yds. per hour
Heavy soil or clay.....	0.95 cu. yds. per hour
Hard pan	0.85 cu. yds. per hour

The earth shoveled out will, of course, have to be moved away by barrows, carts, motor trucks, cableway or other means. Since the first three are the most usual for building construction, they are the only ones that will be considered in any detail here.

However, the student who intends to specialize in excavation to any extent will do well to obtain such books as *Earthwork and Its Cost*, and *Rock Excavation, Methods and Cost*, by Halbert P. Gillette. Either of these books may be obtained from any dealer. Some very valuable material may also be found in Trautwine's *Civil Engineer's Pocket-book*.

The general building contractor will, as a rule, seek either unit or lump-sum sub-bids from excavating contractors when the work to be done is unusually complicated, so the matter contained in this article will be ample to enable him to estimate on any piece of work.

Wheelbarrows are not usually economical except for moving over very short distances, and the amount which one man can transport per 100 ft. per hour is as follows:

	Dry	Wet
Sand or loam	1.8 cu. yd.	1.6 cu. yd.
Ordinary medium soil.....	1.7 cu. yd.	1.4 cu. yd.
Heavy soil or clay.....	1.5 cu. yd.	1.2 cu. yd.
Hard pan	1.4 cu. yd.	1.1 cu. yd.

A two-horse cart, having a capacity of 1.50 cu. yds. of loose material, which equals about 1.20 cu. yds. measured before excavating, can travel at the rate of about two miles per hour when loaded and three miles per hour returning; five minutes must be allowed on each trip for dumping and turning and ten minutes for loading. This quantity is for fairly good roads; if the roads to be traveled are poor, the quantity hauled must be reduced in proportion.

Where the grade of the ramp out of the excavation is very steep, it will usually be necessary to keep a helper or "snatch" team of horses, with driver, on hand to assist the other teams. The cost of this additional team and driver will be distributed over the production of the other teams, and will become less per cubic yard as the production of the other teams increases.

In most instances it will be necessary to keep a man at the dump to spread the excavated material as it arrives. He can usually spread about 10 cu. yds. per hour. If material is delivered at a more rapid rate than that, an additional man will be required. In other instances no provision will need to be made for spreading

¹Copyright 1922 by Charles F. Dingman.

at the dump, but this should always be investigated and considered when making an estimate.

Comparatively shallow excavations in sand, gravel or loose soil can often be handled very economically by means of scrapers, particularly if the excavated material may be disposed of within a very short distance.

The maximum distance for economical use of ordinary drag-scrappers is 200 ft., and for wheel scrapers it is 500 ft.

Since the drag scraper will carry 4 cu. ft. of material (the nominal capacity is 5 cu. ft.) and the team will average a speed of two miles per hour or 176 ft. per minute, it follows that the time cost of moving a cubic yard of earth a distance of 200 ft., allowing 25 ft. at each end for turning and 1/2 minute per trip for loading and dumping the scraper, will be as follows:

27 ÷ 4 = 6.75 trips per cu. yd.
225 ÷ 176 = 1.28 minutes per trip each way, or
2.56 minutes per round trip, plus 1/2 minute for loading and dumping, equals a total of 3.06 minutes per trip; therefore, 6.75 trips at 3.06 minutes equals 20.65 minutes of team time per cubic yard. Allowing for unforeseen delays, this should be figured as 23 minutes per cubic yard.

In addition to the time of the teams and drivers, it is necessary to have at least one man to load the scrapers. He can handle about 150 scrapers per hour, which means that a sufficient number of scrapers should be employed to have them load on 24 seconds headway. Where a less number of scrapers is in use, the helper's time will be distributed over their work at a proportionately greater cost per cubic yard.

Wheel scraper work may be figured by the same method, in each case the actual capacity should be taken as 80% of the rated capacity, and the cost of a "snatch" team should be included when the rate capacity of the scraper exceeds 14 cu. ft. or where the incline is steep.

When the earth is loosened by the plow to prepare for scrapers, the cost of plowing will, of course, be the same as when preparing for hand shoveling.

For very large and fairly deep excavations a steam shovel should show an appreciable saving over any other method of excavation. However, most building contractors do not make a practice of owning their own steam shovels, but will sub-let such work to an excavating contractor at a lump sum or unit price.

Capacities of different shovels of the same nominal rating will vary appreciably and the estimator should be familiar with the performance of the machine which he proposes for any particular work.

If constantly employed in digging, the following production could be obtained from the various sized shovels:

3/4 cu. yd. shovel.....	2.25 cu. yds. per minute
1 1/4 cu. yd. shovel.....	3.75 cu. yds. per minute
1 1/2 cu. yd. shovel.....	4.50 cu. yds. per minute
1 3/4 cu. yd. shovel.....	5.25 cu. yds. per minute
2 cu. yd. shovel.....	6.00 cu. yds. per minute

But, since a great portion of the time of the shovel will be used in moving, it is not wise to figure upon an actual production of more than one-half of the amounts just given.

The cost of disposing of the material will be the same as for hand excavation, except that the loading time will be greatly decreased, one minute being about the maximum if the work is arranged properly.

In practically every building operation it will be necessary to back-fill and tamp the spaces between the banks and the construction. When the earth to be back-filled is available alongside the trench, the cost may be figured on the following basis:

- Sand or loam, 2 1/2 cu. yds. per man per hour.
- Ordinary medium soil, 2 cu. yds. per man per hour.
- Heavy soil or clay, 1 1/2 cu. yds. per man per hour.

When it is necessary to wheel the earth from a pile away from the trench, the cost of such wheeling must be figured as previously explained.

No allowance has been made for foreman, superintendent, timekeeper, etc., in any of our figures thus far. The general building contractor will find it most practicable to estimate the total time required for the entire building and to calculate the cost of salaries for superintendent and timekeeper on that basis.

The time of foreman must, however, be included in the cost of excavating, and, as one foreman can usually handle any ordinary sized operation, the procedure for calculating the unit cost of excavating for a typical building will be as follows:

It is assumed that the soil is dry clay, that the banks will stand without bracing, that shoveling will be done by hand and the material disposed of in a dump a mile away over fairly good roads.

Plowing

Cost of team, plow and driver.....	\$1.00 per hour
Cost of helper	.35 per hour
	\$1.35
	20 cu. yds. = per cu. yd. .0675

Shoveling

Cost of labor, \$0.35 per hour.....	\$0.35
	1.22 cu. yds. = per cu. yd. .2869

Hauling

Cost of team, cart, and driver.....	\$1.00 per hour
Loading time.....	10 minutes
Dumping time	5 minutes
Traveling loaded	30 minutes
Returning	20 minutes
	65 minutes at \$1.00=
	1.0833
	1.20 = per cu. yd. .9028

Trimming Dump

\$0.35 per hr.	
10 cu. yds.	= per cu. yd. .0350

Foreman

Receiving \$0.75 per hour straight time, will average \$0.90 per hour actual time, allowing for rainy days, etc. Assuming that the entire gang is proportioned to handle the maximum amount loosened by the plow, the actual production will be 20 cu. yds. per hour; therefore—	
	.90
	20 = per cu. yd. .045

The water boy at \$0.25 per hour will cost.....	per cu. yd. .0125
	\$1.3497

Contingencies, allow 5%.....	per cu. yd. .0675
------------------------------	-------------------

Compensation Insurance

5% on payroll	.0198
3% on team hire	.0285
	\$1.4655

Or \$1.47 per cu. yd., exclusive of general supervision, overhead costs, and profit.

Bracing

Bracing used in ordinary building excavation may consist of wood, concrete, or steel sheet-piling. Concrete and steel sheet-piling will be discussed in a later paper.

Thickness of plank to be used for sheet-piling, and the spacing of waling strips and braces will, of course, have to be determined by calculating the load which the piling must retain. This is calculated after ascertaining the weight per cubic foot of the material and its angle of repose.

However, for excavations not over 10 ft. deep, 2 in. plank with 6 x 6 wales not over 5 ft. apart, the wales being supported by bracing not over 7 ft. apart, will usually suffice.

For excavations 10 to 15 ft. deep it is best to figure upon 3 in. plank with 8 x 8 wales, not over 3 ft. apart near the bottom, and for 15 to 20 ft. deep, 4 in. plank should be used.

Wood sheet-piling will seldom be found economical for greater depths than 20 ft.

Where union rules or other restrictions do not prevent it, the entire work of sheet-piling can be done by handy laborers, provided they are directed by an experienced man. Where union rules require it, it will be necessary to allow for having certain parts of the work done by carpenters.

Production can be figured upon the following basis:

Setting Braces and Driving Piles

For first 10 ft. of depth	10 sq. ft. per man per hour
From 10 to 15 ft. deep.....	9 sq. ft. per man per hour
From 15 to 20 ft. deep.....	7 sq. ft. per man per hour

Pulling Piles and Removing Braces

For first 10 ft. of depth.....	40 sq. ft. per man per hour
From 10 to 15 ft. deep.....	35 sq. ft. per man per hour
From 15 to 20 ft. deep.....	20 sq. ft. per man per hour

Of course, the men will work in a gang of two or four, but the cost is to be figured upon the basis of the production per man.

The amount of material required for sheet-piling will be determined by the number of times the piling can be used over again on the same job. On most moderate sized jobs it will be advisable to provide enough plank and bracing to enclose the entire excavation at once.

Example.—To find the cost of sheet-piling for an excavation 60 ft. wide, 100 ft. long and 10 ft. deep. The plank will need to be at least 2 ft. longer than the depth of the footing, that is, 12 ft. long.

Distance around excavation, 320 lin. ft.	
320 lin. ft. x 12 ft. plank x 2 in. thick =	7680 FBM, Plank
Wales—3 lines 6 x 6's 320 ft.	2880
Braces—6 x 6's, 45 each 8 ft., 10 ft., 12 ft.,	4050
Stakes—8 x 8, 45 6 ft.	1485

8415 FBM, Bracing

The area to be piled is:

320 x 10 = 3200 sq. ft.
3200 ÷ 10 = 320 hours driving, etc.
3200 ÷ 40 = 80 hours pulling.

Fractional hours are here considered as full hours.

7680 FBM plank at \$36.00 per M. =	\$276.48
8415 FBM bracing at \$44.00 per M. =	370.26

\$646.74

Deduct 60% for re-use value of lumber.....

\$259.68

Spikes (estimated at 20 lbs. per 1000.	
FBM bracing, 168 lbs. at \$.05.....	8.40
Labor driving, 320 hours, at \$.45.....	144.00
Labor pulling, 80 hours at \$.45.....	36.00
Contingencies, allow 5% of labor cost	9.00
Insurance, allow 5% of labor cost.....	9.00
Net cost, exclusive of supervision, overhead and profit.....	\$466.08

Caution—All labor rates and material prices used in this article are arbitrarily assumed. You should be careful to get the actual rates and prices that will be in effect for every job for which you make an estimate.

Whenever possible, the necessary sheet-piling and bracing should actually be designed by a competent engineer, then the amount of material to be purchased and handled can be figured accurately.

Be sure also that your prices for lumber include delivery to the site of the work. Otherwise, you must make due allowance for delivery, as will be explained in a succeeding lesson.

Note also that we have figured on square edged plank, which are the most practicable. If matched plank should be specified, 15% must be added to the quantity of plank, and 10% must be deducted from the amount driven or pulled per hour.

The lesson covering the subject of difficult foundation work will also discuss the subjects of steam-driven sheet-piling, pumping, etc.

Whenever you estimate on the cost of excavating, be sure to visit the place where the work is to be done, obtain all the following information, and make proper allowances in your figures:

- Nature of soil.
- Disposal of top-soil.
- Disposal of other excavated material.
- Location of dump.
- Necessity for spreading at dump.
- Local rate for labor.
- Local price for teams, etc.
- Cost of any permits required.
- Necessity for protecting sidewalk.
- Necessity for protecting pavements.
- Cost of watchman, if needed.
- Cost of maintaining lights, if needed.
- Cost of materials, if any are needed.

Also be sure to include in all estimates a proper amount for general supervision, traveling expenses, home office expense and profit.

Another Testing Laboratory

On page 21 of July CONCRETE we published a list of college and commercial laboratories equipped for testing concrete block and drain tile. In this list we should have included the Materials Testing Laboratory of the University of Michigan, Ann Arbor, Michigan.

Regular and Systematic Testing of Block

C. H. Barnes, president and manager of the B-J Concrete Products Co., Inc., Red Oak, Iowa, points out that if products manufacturers figure on staying in the game they will have to start sooner or later telling to the trade regularly and persistently that they have a standard made article and indicate their intention to keep it so by reporting tests regularly of the products.

Backing up his beliefs along this line, Mr. Barnes submits a report of the Patzig Laboratories, Des Moines, Ia., of compression and absorption tests of B-J concrete block, which is being used in newspaper advertising.

B-J Blocks Best By Test

Stronger Than Need be—Turn Water Like a Duck's Back

Tests made at the Patzig accredited testing laboratories in Des Moines show that B-J Concrete Blocks are even better building material than has ever been claimed for them. The standards for building blocks call for a material that will withstand an average pressure of 1,000 pounds per square inch of surface and remain intact. And that material must not absorb more than 10 per cent of its weight of water by being immersed for a period of 48 hours.

The manufacturers of B-J Blocks were surprised themselves at the results of the tests just completed in Des Moines. Three samples of blocks were sent, picked at random from regular stock by an agricultural engineer of the Portland Cement Association during his round of inspection of concrete products plants. They averaged far above the standard requirements for strength and absorption in the tests. The average strength shows that a pressure of over 1,127 pounds per square inch will be carried by the blocks. And the absorption tests show that the concrete blocks will take less than three per cent of water by being completely immersed for 48 hours. This explodes the common belief that concrete walls will not keep the moisture out, just think of it—less than 3 per cent absorption when the requirement for paving bricks is 2 per cent.

The following is a copy of the original letter, giving the official results of the tests, which is on file in our office.

Patzig Laboratories	MONROE L. PATZIG Consulting Engineer	Building Material Tests & Specifications
Des Moines, Iowa, June 10, 1922		
B-J Concrete Products Co., Red Oak, Iowa,		
Gentlemen:		
We wish to make the following report on the samples of concrete blocks which were received by us on June 5.		
Compression over gross area		
1031 pounds per square inch.		
1213 pounds per square inch.		
1138 pounds per square inch.		
The standard for this test is an average of 1000 pounds per square inch, and none under 700 pounds per square inch. All of these blocks were over the requirement for the average.		
Absorption by submersion for 48 hours		
2.8 %		
2.8 %		
2.0 %		
The standard for this is not over 10%, so that on both tests the blocks came well within the requirements.		
Respectfully submitted, PATZIG LABORATORIES FRANK G. KING		

USE B-J CONCRETE BLOCKS AND YOU WILL NEVER
HAVE TO REBUILD

B-J Concrete Products Co.

Phone 136 Office and Factory 506 Market-st., RED OAK IF IT'S B-J IT'S O. K.

HOW B-J CONCRETE PRODUCTS CO. ADVERTISES QUALITY BLOCK

The B-J Concrete Products Co. not only makes a block better than building laws require, but makes sure that others know it. The advertisement reproduced here occupied a 4-column space, 17 in. deep, in the *Red Oak Sun* of June 30.

Block Regulations and Their Enforcement¹

After a long period of more or less uncertain progress the concrete block industry has shown during the last two years unmistakable evidences of rapidly accumulating vitality. While in years past the output in many localities was small and of undependable quality, more than 175,000,000 concrete block were made and marketed in the United States in 1921. This output would be easily equivalent to more than 2,000,000,000 common brick. Cleveland used some 4,000,000 block, Pittsburgh about 2,750,000, Toledo 2,250,000, and Minneapolis over 3,000,000.

The problem of securing a uniformly dependable output throughout the country is complicated by the fact that there are some 6,000 manufacturers, large and small, and it remains easy for almost anyone to embark in the block business at small initial outlay, although the average size of these concerns is increasing rapidly. A large majority of the building officials of this country have at some time been confronted with the difficulties of inspection and regulation naturally attending a manufacturing situation of this kind.

In the belief that the market for concrete block and other structural units offers one of the largest fields for the use of concrete, the Portland Cement Association started an extensive study of the concrete block industry three years ago. The analysis thus obtained showed both the need for and the possibilities of a nation-wide campaign of education among the makers and users, with the object of improving practice in both manufacture and use of these units. Such a campaign was inaugurated immediately, and the research and field investigations have been continued. The latter have revealed a great deal of information pertaining to the bearing ability, resistance to moisture, fire resistive qualities and other important considerations having to do with the details of the manufacture and use of these units.

What I have to present as suggestions for a city code section is based on our own studies made with the assistance of the Lewis Institute Structural Materials Research Laboratory, and a corps of field investigators, and also upon suggestions from leading block manufacturers and the members of various technical committees which have studied this subject at one time or another. An effort has been made to put the suggestions briefly, but not at the expense of omitting anything really essential.

Nothing has been said in these code suggestions about manufacturing methods or mixtures, because with the standards of quality definitely set, the practices used to obtain these standards are of only secondary importance. Our experience shows that there are many possible ways of attaining these standards in block manufacture, and also, that while some of these methods are possible under a variety of conditions, none can be prescribed as suitable for every case. It is hardly fair and occasionally works an undue hardship on manufacturers to fix by law both the results to be obtained and the detail methods of manufacture. Methods in the industry may continue to change faster than the ordinances, and it would be unfortunate and perhaps harmful to public interests should the industry be legally tied up to out-of-date methods. Such requirements have not

to our knowledge been used in regulating brick, tile and other competing masonry materials. What is required is a definite standard of quality and effective machinery for maintaining quality at the standard set.

The proposed ordinance sections are brief and will be read through first, after which comment will be made on the various provisions.

BUILDING CODE REGULATIONS FOR CONCRETE BLOCK AND CONCRETE STRUCTURAL TILE FOR BEARING WALLS AND PIERS

SECTION 1—CONCRETE BLOCK—DEFINITION

Building units such as concrete block and structural tile, for use in bearing walls and piers in the city of..... shall be made from portland cement and suitable aggregate, and shall be classed as concrete block and shall comply with the following requirements.

SECTION 2—TESTS REQUIRED

Concrete block shall be subjected to the following tests before their use is approved by the Building Department:

(a) *Compression*—All concrete block intended for use in bearing walls shall be subject to a compression test.

(b) *Absorption*—Concrete block, the face of which is to be exposed in the finished work, shall be subjected to an absorption test.

SECTION 3—METHODS FOR MAKING TESTS

(a) For these tests at least three samples shall be selected at random by a representative of the Building Department. The samples shall be of the regular size, as used in construction, and must be marked for identification. In case of failure of first three specimens to meet requirements, three more specimens shall be taken and the test repeated. The second test shall be final.

(b) These tests shall be made in a testing laboratory of recognized standing, in accordance with standard methods prescribed by American Concrete Institute. All tests shall be made at the expense of the manufacturer.

(c) The Commissioner of Buildings shall require, at least every six months, a certificate of test of product made by every manufacturer and selected by a representative of the Building Department. The Commissioner of Buildings may require additional tests to be made on samples selected by him whenever, in his opinion, there is doubt as to whether the product meets the standards prescribed by these regulations.

SECTION 4—STANDARDS OF QUALITY

(a) The ultimate compressive strength of hollow and two-piece block at 28 days, or when delivered to site must average 750 lbs. per sq. in. on the gross cross sectional area of the block as designed to be used in wall, and must not fall below 650 lbs. per sq. in. in any test.

(b) Where the absorption test is required, it will be made upon the specimens before they are used for the compression test. No block shall absorb more than 10% of its dry weight when tested as previously specified in Section 3, Paragraph (b).

SECTION 5—LICENSING

(a) Every manufacturer of concrete block or dealer therein must secure a license permitting the sale of such block in the city of.....

(b) Said license shall be granted as soon as certificate of test is presented to Building Department, showing that block have met above requirements. The name of the firm or corporation and responsible officers must be placed on file with the Commissioner of Buildings before the license is granted. Changes must be promptly reported.

(c) Penalty for first failure to meet the requirements of this code shall be one month's suspension of license, and for second failure revocation of license for one year.

SECTION 6—MARKING FOR IDENTIFICATION

(a) A mark of identification shall be impressed or otherwise permanently attached to each block by the maker thereof before said block leaves the yard of the maker or dealer, unless said block be of some exclusive and distinctive shape by which it can be quickly and easily identified. A copy of the mark or other distinguishing feature shall be filed with and approved by the Building Department.

SECTION 7—CONCRETE BLOCK CONSTRUCTION

(a) Concrete building block which have the approval of the Building Department may be used for buildings wherever solid masonry is permitted by this code, subject to all the limitations required for solid masonry and subject to the allowable working stresses hereinafter specified.

(b) The allowable working loads on all concrete block shall not exceed 1/10 of the average crushing strength of the

¹From a paper presented before the Building Officials Conference, Indianapolis.

block when laid in lime-cement mortar, and shall not exceed $\frac{1}{8}$ of the average crushing strength of the block when laid in portland cement mortar.

COMMENT ON FOREGOING CODE SUGGESTIONS

Concrete building units of the block class include what are known as concrete block and concrete building tile. The principal difference between block and tile is the proportion of the gross volume occupied by the air space. Ordinary block have air spaces equal to about 33% of the gross volume, although certain types have air spaces occupying as high as 50%. Concrete building tile has air spaces commonly around 50%, and in one case as high as 75% of the gross volume.

The compression test offers the best method of measuring the bearing ability of the block. It has been suggested that building ordinances require block to carry 750 lbs. per sq. in. on the gross areas as laid in the wall, which we feel is a reasonable requirement from every point of view. Seven hundred fifty pounds per square inch on the gross cross section actually means 1,125 lbs. per sq. in. on the net area of an average concrete block having 33% air space, or 3,000 lbs. per sq. in. on the net area of the concrete tile having 75% air space. Three thousand pounds per square inch on the net section is about the limit of what can be reached economically, considering adverse conditions encountered in some parts of the country.

Seven hundred fifty pounds on the gross cross sectional area is therefore a feasible figure so far as manufacturing possibilities are concerned. Judged by the requirements for such competitive materials as hollow tile, which are commonly placed 700 lbs. on the gross area, 750 lbs. for concrete block is more than sufficient. In the light of recent investigations on the relative strength of these competing units in piers, the concrete block shows up very well indeed. In tests made at Lewis Institute, copies of which I have attached to my paper, a typical concrete tile developing an average of 1,260 lbs. on the gross area developed from 670 lbs. to 1,080 lbs. on the gross area in piers laid up in cement mortar. Competing clay tile which were of same gross dimensions, developed an average of 630 lbs. on the gross section tested individually. Laid up in a comparable wall section, using portland cement mortar, the clay tile tested 150 lbs. on the gross section.

The ratio of the load sustained by the clay tile in a wall section to that sustained by individual clay tile, is about 24%, while the ratio of the load sustained by a comparable wall section of concrete tile to the average load carried by individual tile was 55.6%. It is plain from these tests as well as others of a similar nature that if we require comparable unit stresses on individual concrete and clay units laid in cement mortar, the concrete units will develop stronger masonry. Portland cement mortar is, of course, the standard mortar for good construction.

As an illustration of the sufficiency of 750 lbs. on the gross area for the purposes to which these concrete units are generally put, I can say that my own $2\frac{1}{2}$ -story concrete block house, in which 170 tons of concrete were used, loads the footings to the extent of approximately 25 lbs. to the square inch.

Additional strength in these units above the minimum requirement merits recognition in the shape of additional allowance as to the load permitted. If the ordinary 750-lb. block is permitted 75-lb. loading, it seems fair to permit additional loading on walls of stronger block, equal to $\frac{1}{10}$ the demonstrated strength of the block in compression if laid in lime cement mortar on $\frac{1}{8}$ the

strength if laid in portland cement mortar. I think you will agree that these ratios are moderate, and that some recognition should be made of this superior strength developed by portland cement mortar.

As a substitute for the flat minimum requirement of 750 lbs. per sq. in. on the gross area, there has been suggested a graduated or classified scale of requirements depending upon the use to which the block are to be put. The following table, taken from a specification proposed for adoption by the American Concrete Institute, classifies block according to various possible requirements and from a strictly technical standpoint is quite consistent. Such a graduated scale may be more difficult for builders to understand and for building departments to enforce, and in many localities the refinements seem greater than local usage would require, at least at this moment.

Unit	Compressive Strength Requirement of Unit in Lbs. per Sq. In. of Gross Area		Allowable Load, lbs. per sq. in.
	Average of All Tests	Individual Minutes	
Heavy bearing block or tile	1,200	1,000	200
Medium bearing block or tile	700	600	75
Light bearing block or tile	500	400	40
Non-bearing block or tile	250	...	{ Sufficient to handle

(In no case shall concrete for block or tile for bearing wall construction have a compressive strength of less than 1,000 lbs. per sq. in., based on the net area of the block or tile as used in the wall.)

In the suggested 750-lb. requirement and in the table as well, you will notice that the average requirement has been accompanied by a minimum below which no individual specimen may fall. This provision is very significant because it tends to secure uniformity of product. A very good specimen cannot cancel off a poor one. This is a provision not commonly placed in code regulations of masonry units, but one which we believe should be used in connection with all of them.

ABSORPTION REQUIREMENT

The absorption requirement is simple and the percentage of absorption allowed is considerably below the average for most materials put to similar use. The criticism is rightly made that this test is not directly comparable to any requirement in actual practice. In an effort to get closer to actual conditions of exposure, it has been proposed to immerse only the face of the block to a depth of a quarter of an inch. This distance would represent the maximum depth of raked joints. The amount of water absorbed in such a test would constitute a good gauge of the capillary action, and is directly comparable with what we have dealt with in practice. This method seems correct in principle and an elaborate series of tests is now under way to determine what percentage of absorption by this method may be considered fair limit to specify in the codes.

There is no particular advantage in testing for absorption material which is to be entirely covered with stucco, plaster or other coatings. In fact, more porous concrete often has a greater insulating value.

ENFORCEMENT IMPORTANT

Block of acceptable quality can be assured if occasional samples are selected by the building inspector, tested in an approved laboratory at the expense of the manufacturer, and certified copy sent by the laboratory to the Building Department.

By this plan the manufacturer will be able in many

cases to take the specimens to the laboratory himself and see them tested. In such cases he can see for himself that the entire procedure is fairly conducted. He pays for the tests and they are his, so he may quite properly use them as he sees fit. Good results will give him excellent advertising material and will make sales more difficult for low-grade competitors. The manufacturer is likely to develop quite a lively interest in his tests. He naturally feels proud if they are good, and he cannot escape their condemning influence if they are poor. Several nearby towns frequently are willing to accept one set of tests, if made as indicated, saving quite a lot of testing where a given manufacturer serves several communities.

Is it too much to expect the city building departments to do the few things necessary to secure quality products under this plan? Are their facilities too limited to allow a few personal inspections per year to the factories for the purpose of marking specimens for test? Few building commissioners have at their disposal sufficient funds to meet all demands, but here is a plan under which the building department is relieved of the greater part of the expense of enforcement. What is needed in the block industry even more than better codes, is better enforcement, and the suggestions made in earlier paragraphs have been formulated with this thought in view. They tend to make enforcement simple, positive and inexpensive. The block maker meets the building department more than half way, with results which are sure to protect the quality of concrete building units and help to stimulate their use where economical and appropriate.

Concrete Stairways in Park, Dubuque, Ia.

The illustration (Fig. 1) shows a reinforced concrete stairway that replaced an old wooden one several years ago in Madison Park, Dubuque, Ia. It is 83 ft. 4 in. high.

The steps are precast; they are 5 ft. wide, with 6 in. risers and 13 in. treads, placed on 10 in. by 14 in. stringers. The piers are constructed of precast cored blocks, 16 in. square and 8 in. and 12 in. high. The reinforcing in the steps consists of two $\frac{3}{8}$ in. rib bars; in the stringers, of two straight and two bent $\frac{1}{2}$ in. rib bars.

All piers have two $\frac{1}{2}$ in. bars in the cores, which were

filled. Pipe tees, $1\frac{1}{2}$ in. in diameter, are embedded in the steps and landings, as connections for pipe railings. The posts are made of $1\frac{1}{2}$ in. pipes. The railings are $1\frac{1}{4}$ in. black pipes, except when used to carry electric wires when regular $1\frac{1}{4}$ in. reamed conduit pipe is used.

The circular steps are also precast, and rest on the lugs of a 3-ft. newell on the inside and a curved stringer on the outside.

G. A. Heyne, superintendent of the Dubuque Park Commission, who built this stairway has also constructed several others. His description of methods used in constructing the Eagle Point stairway follows:

In starting we staked out the elevations and lined out the walls, clearing the projecting ledges and drilling for dowels at each pier. The bases of piers are 2 ft. by 2 ft., tapering to 18 in. at the top. The pier forms were used over several times, effecting a saving in lumber. The walls between piers were mostly of uniform length. As all vertical faces were finished with rough-cast stucco, form marks did not matter much. Having a lot of broken stones chipped from the ledges helped considerable in filling wall and pier forms.

At the start we hired quite a few men and then retained ten of the best men. In this way we found the men suitable for various jobs, as form setters, mixer men, and finishers.

The stairway runs in the form of an "N," the first and last run being somewhat longer than the middle one. We set up the forms for a run, including the half circle at end. This wall was formed in hexagon shape at turn, using straight lumber.

The bottom shores were hooked on to the dowels with wires, as it was impossible to drive any stakes in the solid rock. We ran the whole length of one run before putting in the steps. The steps are all 5 ft. wide, risers 6 in., and the straight steps with 12 in. treads. This made the work uniform and easy to lay out; the wearing surface was placed 1 in. deep on steps and landings, at the same time embedding standards for pipe railing. All measurements were under my supervision, to avoid errors in line or elevation. We tried to have all the step forms set in the afternoon, so as to be able to start to fill early the next morning and avoid overtime work on finishing. We had two good men finishing with a good quality of sharp (washed) river sand. While pouring the steps the form setters were building the next run of forms, and also building up the tower and runway for next run.

The thickness of wall is 12 in., excepting the top 12 in., which were only 8 in. thick; this part is above the steps and holds the pipe standards for railings. The piers were built up with block 16 in. square and 4 in. thick, cast in iron molds; the caps were made in plaster molds, and were placed after fitting the pipe railing in the square posts. This makes a very strong arrangement for supporting the rails.

The Montrose Terrace stairway was built of monolithic concrete, the mix being chuted into the forms from the top of the hill. It is 100 ft. high. The steps are 5 ft. wide, with 6-in. risers and $12\frac{1}{2}$ -in. treads. They are reinforced with $\frac{3}{4}$ -in. square twisted bars on 12 in. centers. The mix was 1:2:4. The railings are of the same construction as the other two stairways. All vertical surfaces on this job were rough cast.



FIG. 1 — REINFORCED CONCRETE STAIRWAY IN MADISON PARK, DUBUQUE, IA.



FIG. 2—EAGLE POINT STAIRWAY



FIG. 3—MONTROSE TERRACE STAIRWAY



FIG. 1—COMPLETED REINFORCED CONCRETE SAFE

Reinforced Concrete Safe

An improved type of reinforced concrete safe is being manufactured in Germany, according to patents held by Dr. Von Emperger, a German authority on reinforced concrete. These safes have no metal exposed, and therefore are fire and burglar resistive, because the ordinary oxygen cutting tools are ineffective against concrete and drills and other tools of this kind are too noisy.

The weight of concrete safes is not greater than steel safes of the same size, and it is reported that the manufacturing cost is a little less.

Fig. 1 shows the appearance of the finished safe, for the reinforcing details of which see Fig. 2. The body of the safe and the door are cast in iron molds. These safes contain no other steel than the reinforcement of the concrete, and a few steel frames and a lining. The reinforcement consists either of Monier netting or machine coiled spirals which are interconnected. This reinforcement varies according to size and to the requirements for strength. Steel filings are sometimes mixed in the concrete.

The greatest difficulty encountered in the construction is the door frame, which, like the ordinary type, is made of steel. It is set back 2 or 3 in. towards the interior, and is therefore protected against fire by concrete of this thickness. The bending of this frame under the influence of fire, which is sometimes noticed in steel safes, is impossible. Such concrete safes have been dropped, with no appreciable damage, from 12 ft. to 16 ft., even though pavement stones, steel joists and rails have been used as a covering of the surface of the

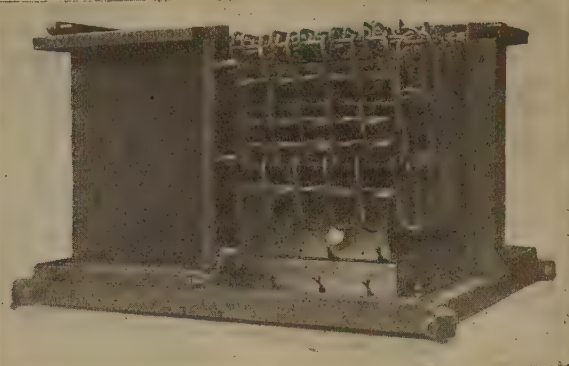


FIG. 2—VIEW OF MOLD ASSEMBLY AND REINFORCEMENT

impact to aggravate the effects of the drop. The process of construction has been devised with a view to manufacturing in quantities.

The connection between the steel and concrete parts is strengthened by ties of twisted flat bars, which become embedded in the concrete. After the molds (made of several pieces accurately machined) are completely assembled, the reinforcement is placed, and the inside and outside casing spaced by a frame bolted to the top. The concrete is then poured and tamped. A mixture of 1 part of cement and 6 parts of basalt or slag gravel is used. The outside casing can be removed after one day, and the core after two or three days. The core is of course collapsible. After three or four weeks the safes are ready to receive a coating of paint.

Floor Tile

Decorative concrete floor tile are being manufactured by the National Mosaic Tile Co., Mobile, Alabama, under the trade name of Adamantile, and have attained a wide use in this country, and have been exported to Cuba, Mexico, and Canada, accordingly to *Contractor's Atlas*.

A facing mix of white portland cement and a special imported mineral color pigment mixed to the proper proportions and to the proper consistency, is first poured into highly polished steel molds of various sizes. The molds are then filled with a body mix of common gray cement and sand, closed and subjected to a hydraulic pressure of 4,500 lbs. to the square inch. The tile is then removed from the mold and placed on a rack until sufficiently hard to handle. Tile are then wet down and left to cure.

The product is made in sizes ranging from 4 in. by 4 in. to 8 in. by 8 in.

This company also manufactures a tile with a face composed of a finely ground quartz or granite mix, which shines brilliantly when polished. These are called Diamantile, and have beauty and distinctiveness as well as exceptional wearing quality.

These tile are beautiful, do not warp, have a smooth, agreeable, non-slippery surface, and can be produced in all plain solid colors and shades, as well as practically unlimited design patterns. The colors are permanent, some of this tile having been laid for more than twelve years without loss of color. The beauty of these tile is said to improve with age. The individual needs of the buyer, as well as any style of architecture, can easily be satisfied by these tile.

Inspection of Portland Cement¹

By J. R. DWYER AND ROB N. YOUNG

(Concluded from August Issue)

Samples should be protected from the weather and should not be stored under conditions which are likely to affect them, such as cold storage, moist air or the vicinity of steam pipes or stoves. They should be shipped promptly, as the effects of aging should be avoided as much as possible.

Some mills request that a part of each sample be given them for tests in the mill laboratory. This practice should first be authorized by the laboratory. Before making such divisions, each sample should be carefully mixed by rolling on a paper. Moreover, it is desirable that it be thoroughly understood that this is done only for the information of the mill, and that the mill's tests will not be considered as in any way decisive.

For full tests according to the Government specifications in effect January 1, 1921, samples should weigh approximately five pounds, thus insuring a small reserve for any necessary check tests. The inspector should make no tests in the mill laboratory unless so directed by this office.

VII. PACKING AND SHIPPING

Conveyors—Before the seals are removed from a bin for the purpose of drawing tested cement, the conveyors should be traced to the packing machine. They should be clean of all cement and also the bin of the packing machine should be empty. While the cement is flowing from the bin, frequent trips should be made along the conveyor to see that cement is coming only from the desired source. This point cannot be too strongly emphasized. If packers are working on a piece work basis and cement is not flowing as rapidly as they desire, it occasionally happens that sources of supply are used in addition to that of the tested stock.

Weight of Packages—If the bags are tied too far down, or the machines improperly set, or if the packers, in an effort to increase output, cause the bags to become detached before the proper amount is placed therein, the purchaser may lose a considerable part of the cement he pays for. Instances have sometimes come to attention where the discrepancy was as much as ten pounds per bag on numerous bags. The weights can be checked by having random trucks of loaded bags run upon a platform scale. The U. S. Government Specifications provide that a bag shall contain 94 lbs. net and a barrel 376 lbs. net. They further contain the following paragraph concerning unit weights:

Packages varying more than 5 per cent from the specified weight may be rejected; and if the average weight of packages in any shipment, as shown by weighing 50 packages taken at random, is less than that specified, the entire shipment may be rejected.

If necessary the tare weight can be determined by weighing a number of the empty containers.

Including additional packages to make up for shortage in weight of other packages, is open to the objection that the package is generally used as the unit in concrete mixing, with the assumption that it represents the usual standard weight; therefore, this practice should not be allowed.

DEPARTMENT OF COMMERCE BUREAU OF STANDARDS	
CEMENT SAMPLE REPORT	
Mill:	Company:
Location:	
Bin No.	
Capacity:	barrels
Date sampled:	How sampled
By Inspector:	
Samples forwarded to	for test.
Via	Express Company from
on Gov't Bill of Lading No.	enclosed herewith.
Seals on bin:	
Number of samples:	Number of bags:
Bags fastened with seals numbered:	
Reported by _____	
Note: If car samples are taken, follow above form as fully as possible, listing cars, consignees and date of shipment on reverse of this sheet.	
Form 105	

Containers—Cloth bags have become a costly part of the marketing of cement. There are in use various grades of bags, each with its refund value as agreed upon in the purchase order. It is therefore essential that the bags which are specified in the purchase order be used in making the shipment, and, to prevent loss of cement and insure refund for empty bags, torn or defective bags must be rejected. Bags improperly tied should be rejected. When paper bags are used, it is customary to add approximately 2 per cent empty bags to replace any broken in transit. Packages should bear the name of the maker and the brand and all marking should agree with the contents, both as to quantity and quality. If cement is to be shipped in wooden barrels or special containers, attention must be given to the details as set forth in the order.

When an inspection stamp or other identification is desired on the packages, it should not be applied until the packages are properly filled with tested and accepted cement.

Loading and Inspecting Cars—The number of barrels of cement in a car is readily obtained by computing the number of bags in a pile, the piles in a row, and the number of rows. In case of disagreement between the inspector's tally and that of the mill, the discrepancy should be eliminated before the car is sealed.

The condition of the car should be determined before loading, if possible. Cars should be clean and dry. Roof should be examined for leaks, and sides and doors should be in condition to protect the contents. If refrigerator cars are used, all ice should be removed.

When cars are scarce and cement urgently needed, cattle and coal cars are sometimes used. Such cars should be authorized by the testing laboratory before packing. Cattle cars are usually lined with paper and coal cars covered by tarpaulins. If doors are broken or missing, protection should be obtained by boards and paper across the opening.

To prevent damage to bags and loss of cement, all projecting nails should be removed from the floors and also from the walls of the cars to a height sufficient to

¹Published by permission of the Director of the Bureau of Standards.

DEPARTMENT OF COMMERCE
BUREAU OF STANDARDS
WASHINGTON

Shipment of tested Portland cement was made from bin

Mill

Consigned to

Contract

This cement was loaded under Bureau of Standards supervision.

Car initials	Car number	Bureau of Standards seal number	Barrels shipped	Date shipped

Twenty-eight day tested cement has met the United States Government specifications as contained in Bureau of Standards Circular No. 33, 3d edition, in every respect
Seven day tested cement has passed the 7 day tests, and if accepted, reports of 28 day results will not be made unless requested.
If shipment is made from untested stock, you will be notified of 7 day results, and if requested, of 28 day results.

BUREAU OF STANDARDS.

SHIPPING REPORT.
Form 295.

clear the cement bags. If the cement is packed in paper bags the bags should be so arranged in the center of the car that jolting in transit will not throw them to the floor and break them.

To many of the large jobs and users, cement is now being shipped in bulk. The foregoing notes in regard to the general condition of the cars apply, but doors should be closed by tongue and groove boards, or other means, to prevent loss in transit. The quantity of cement must

CEMENT INSPECTION DIVISION,
BUREAU OF STANDARDS,

SAMPLE SLIP.

Date

Mill

Consignee

Destination

Car
Bin

Barrels

Inspector

B/L No.

Weight Entire Shipment.....

Total Number Bags.....

This is Bag Number.....

Seal Number.....

Shipped from

Mill

Bin

Date Shipped

Inspector

Form 295.

be determined by weight after the car is loaded. If the inspector cannot conveniently be present when the cars are weighed, he might at intervals compare the weights given him with those in the railroad records.

Careful check on quantities is always desirable. At times it serves the maker as well as the purchaser to have proper certification from the purchaser's inspector.

Sealing Cars—The last, but by no means the least important step is the sealing of the cars. Cars should be sealed by the inspector immediately after packing. Seals are necessary on all doors and openings. Seal numbers should be carefully noted, together with the initials and number of the car.

Some cars are provided with a lever device for opening the door. In such cases a seal should also be applied to the lever, if it is of a type permitting sealing. If the lever is unsealed, railroad men will sometimes raise it and partly open the door to see within. Should any of the bags lodge against the door, preventing its being closed again, the contents may thus be exposed to the weather. If the inspection seals on a loaded car have

been broken, responsibility should not be assumed by the inspector for quantity or quality. The matter should be referred to the inspection laboratory before resealing the car.

Car Reports—After a car has been packed and the contents tallied and inspected, and before sealing the door, the inspector should tack in a prominent place any car inspection report or notices in use by his laboratory. These notices may save much time and misunderstanding should the detailed shipping reports of the inspector not be available to the official in charge of the receipt and unloading of the cars.

Transportation by Other Than Railroad Cars—Transportation by wagon, truck, or barge does not always permit sealing and identification as practiced on freight car shipments. In such special cases arrangements should be adopted which will best serve the needs of the occasion.

General—It is well to avoid packing cars with cements of different status of test, such as "24-hour" and 7-day tested cement, since failure of one lot may require the rejection of satisfactory cement which has been packed with it. This matter is best left to the decision of the inspection laboratory.

VIII. CEMENT IN TRANSIT

After the car leaves the mill it is not often that it will be again seen by the inspector. However, cases have arisen where the inspector, because of his location, has been requested to assist in tracing cars, obtaining data, as to delivery dates, when the records of the job were incomplete or lost, investigating broken seals, expediting shipments, and locating cars in transit in order to intercept them at transfer points and obtain new samples. Such matters are best left to the judgment of the inspector, assisted by such instructions as may be given him in the case. At such times he will find it of great assistance to have the cooperation of the mill and local railroad men.

IX. RECORDS

Notes—All notes should be made directly in a permanent leaf notebook, in order to provide a means of duplicating any report which may be lost or destroyed.

Seals—Seals must be numbered, otherwise they are but a poor and uncertain identification. Moreover, even if numbered, their careless or unauthorized use may sometimes cause misunderstandings. It is advisable that they

CEMENT INSPECTION DIVISION
BUREAU OF STANDARDS

CAR REPORT

Car No. contains barrels

..... cement which has met the United States

Government specification requirements for

Date Packed by

Car received by

Condition

THIS SLIP TO BE PLACED IN CAR CONTAINING SHIPMENT OF CEMENT IT DESCRIBES.

Form 296.

be carefully kept where the inspector alone has access to them. If circumstances should require that other seals be used, as those of a railroad, the number and initials should be fully recorded and the proper notes made on the report. The inspector should record and report

the number of each seal used by him, also record and compare with previous reports the number of each seal he breaks.

Reports—Reports should be definite and complete. This applies especially to samples. Inspection, sampling and testing will have been done to no avail if the identity of samples is not properly established. Efficiency is impaired if the records are so incomplete that desirable information cannot be secured. The time and money spent, as well as the certainty of results desired, surely warrant the expenditure of time sufficient to make careful and complete record. The inspector should keep his laboratory posted as to his location and travel dates.

Forms—Most laboratories have devised the forms required for their records and reports. These must necessarily vary according to the needs of the service.

X. DANGERS

It behooves both the experienced man and the novice to have ever in mind the motto, "Safety First," while engaged in work around the cement mill. To the novice especially a few words of warning are fitting, for, in addition to the usual precautions against injury from cars, machinery and such other causes as may be well known to most men, attention must be paid to certain sources of danger which are more or less peculiar to the cement mills.

Foremost among the causes of accidents in plants are the screw conveyors. A look at one in motion should convince the inspector that a serious, if not fatal, accident will result if an arm or leg is caught by the screw. Avoid taking samples from screw conveyor. When working above bins, insist that covers be on any screw conveyors which may run beside the walkway. In such a location a screw has frequently been seen uncovered at a short height above the walkway. At night time, or in a dimly lighted part, it would be easy for a man to stumble and have an arm caught in the screw.

In the alleyways and tunnels leading from the bins one might find that the conveyor covers are not always in place or a space between covers or gratings may exist. These faults are not always evident, since they may be concealed by cement or an empty sack placed over the opening to prevent escape of dust. Therefore, while insisting that all covers be placed where he must work, the inspector should never walk upon the covers. The inspector should insist on the mill furnishing lights and other facilities adequate to permit the performance of his work in safety.

Do not walk among belts, gears, and chains if it can be avoided. Avoid line shafts, since projections on rapidly revolving shafts are not always visible. Be on the lookout for electric wires, especially around the tops of the storage houses.

If the inspector finds it necessary to go in the vicinity of the quarry, he should consult someone in charge and avoid danger from blasting operations.

In addition to the foregoing dangers, there exist those peculiar to the cement itself. Dust soon settles on the overhead timbers of the storehouses and any climbing should be done cautiously. When filling bins, the space above them will often be sufficiently cloudy with dust to make it difficult to distinguish objects clearly.

If it becomes necessary to walk upon the surface of the cement in the bins, do so cautiously and only in company with the mill men. The cement may be very warm. The surface may be especially fluffy or lightly deposited, causing difficulty in walking. Should one fall into the

cement from the top of the bin, the consequence might be serious.

Often a steep bank of cement forms in the bins by the removal of part of the contents, and in the large storehouses, where a traveling conveyor cuts a precipitous slope in the remaining cement. Also in bins the cement will form steep slopes when being filled. Keep away from such slopes. Men have been buried beneath sudden slides of cement, with fatal results.

Before starting work, inquire of the superintendent or foreman in charge as to the existence of any unusual conditions which should be guarded against.

Report promptly in writing to the inspecting laboratory any dangerous conditions which are not remedied.

Use caution in crossing tracks and when working on or around cars, and sealing cars, especially if an engine is coupled to the train or is nearby. Do not seal cars while they are in motion. Do not sit in the doorway of a car or on the floor of a loaded car.

Serious effects seldom come from breathing dust, but the irritation, which is experienced by one unaccustomed to the dust, may be avoided by breathing through a wet sponge or respirator.

Silage and the Dairy Cow

By W. L. GAINES
PROFESSOR, UNIVERSITY OF ILLINOIS

Silage is to the dairy cow what wheat is to mankind. Wheat supplies one-fourth of all human food (United States) and silage supplies one-fourth of all cow feed. Man cannot live by bread alone, and cow cannot live by silage alone. Wheat is the cheapest human food and silage is the cheapest cowfeed. There is also a difference—wheat has been used for ages, where silage has been used for years.

Ten years ago (1912) less than one-third the dairy farms in the Chicago milk district had silos. Today probably 99% of these same farms have a silo or two, or three, or half a dozen, whatever is needed to store all the silage the cows can use. Why this remarkable increase in the use of the silo? The answer is simple and convincing. It pays in dollars and cents. Consider the labor income (what the farmer has left for his own time after paying expenses and interest on his whole investment) of the farmers having silos and those not having silos.

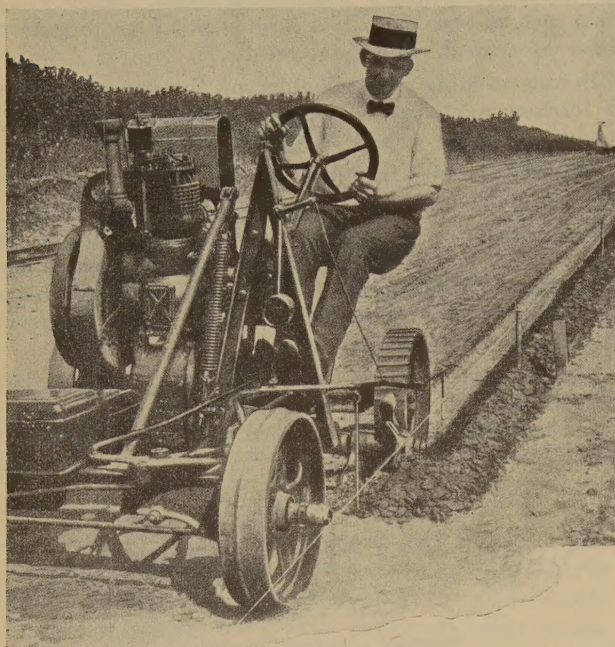
Item	Farms with Silos	Farms without Silos
Labor income	\$820	\$447
Number of farms.....	204	411
Acres in farm	159	160
Acres in pasture	47	49
Number of cows	32	30
Milk sold, per cow.....	90	82
Whole capital.....	25,000	23,000

(Above data are averages based on survey made in 1912 by Dairy Department, University of Illinois.)

The farmers using silage received nearly twice as high a rate of pay as their neighbors without silos, nearly \$400 per year extra wages. And those were days when \$400 was a lot of money to the farmer—the same it is a lot of money to him today. At that time the silo was perhaps the greatest single thing in farm equipment and feeding practice that the dairyman could adopt to increase his returns. While practically every intensive dairy farm now has silos, there is still a great section of the country where the silo is just as much needed and just as certain of being profitable, in a smaller way perhaps, as was the case on these dairy farms 10 years ago.

A Grader for Road Forms

The Carr formgrader¹ cuts a uniform, true-to-grade foundation for road-building forms at a rate of from 300 to 700 ft. per hour. The operator sits on an approved type of cultivator seat. The hand-wheel governs the depth

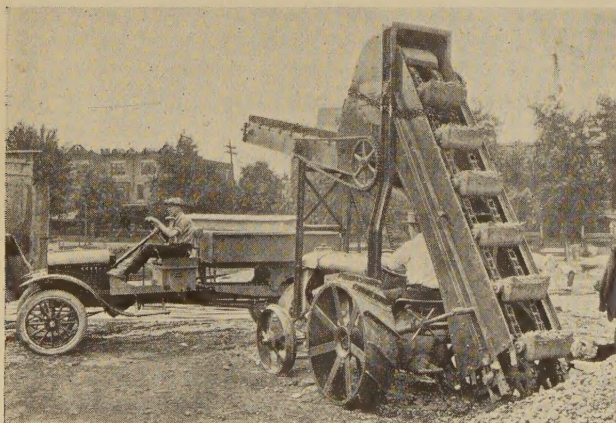


CARR FORM GRADER AT WORK

of cut and the steering is done by the foot pedals. By keeping a careful eye on the second guide that slides along with hair spring pressure against the grade line, the cutter can be kept to almost perfect grade. All the controls are within easy reach. The cutter knives, although each only cuts 1 in. wide, are so staggered that they cut a trench 8 in. wide and throw the earth along the shoulder.

Wagon Loader on Fordson Tractor

A portable wagon loader for earth, stone, gravel, sand and similar materials is being manufactured by the Specialty Engineering Co., Philadelphia, intended for use with a Fordson tractor for power. The loader is mounted on the tractor, as shown in the accompanying illustration. It consists of three parts: the supporting



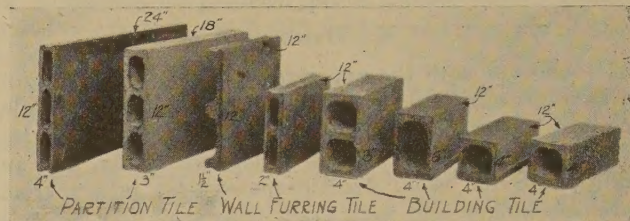
PORTABLE WAGON LOADER MOUNTED ON A FORDSON TRACTOR

¹Edward G. Carr, Chicago, Ill.

frame, the elevator, the conveyor. The elevating equipment consists of steel buckets operated by endless chains and working on rollers. The material is raised by the buckets deposited upon a conveyor and shoved forward into the truck or wagon.

Frosell Building Tile

New light-weight building tile have been designed by Oscar Frosell, Williamsport, Pa. He proposes to make them of various materials for interior and exterior use—as insulator block to line masonry walls, as structural wall tile, and as partition tile. For interior use he will use sawdust mixtures, and turn out the tile with surfaces sufficiently smooth so that plastering will be ob-



NEW DESIGNS OF LIGHT WEIGHT BUILDING TILE WITH SAWDUST AGGREGATE.

viated. The inventor proposes using magnesite mixtures for some of his tile.

Mr. Frosell is developing machines for manufacturing these tile—a partition tile machine, he says, to turn out 4,000 sq. ft. a day with three men. The building tile machine, which makes all the other type units, will turn out 3,000 tile a day with three men.

The inventor anticipates making 4 in. by 4 in. by 12 in. building tile to undersell ordinary brick at \$20.00 per thousand.

Larger Motor for Smith Excavator and Loader

Announcement was previously made of the use of the Wisconsin 4-cylinder gasoline engine on Smith Pavers. This has led to the adoption of this motor on Smith excavators and loaders. It provides about 40% additional power over the previous equipment.

Testing Concrete Pipe

An ingenious device has been developed by the California Association of Concrete Pipe Makers for conducting hydrostatic tests on single lengths of concrete pipe without the employment of the usual false ends and tie rods. The apparatus consists of two aluminum cylinders fitting one inside the other. Both have flanged ends and a tubular India rubber gasket fits between the inner and outer flanges at each end. The outer flanges can be adjusted so as to fit tightly against the interior of the pipe, and after this has been done the tubes are inflated with water supplied under pressure, thus causing them to press tightly against the concrete. Water is then admitted to the space between the outer aluminum cylinder and the interior of the pipe. Pressure in the gaskets and the pressure chamber can be supplied from the same source and increased at the same rate after both have been separately brought up to about 50 lbs. per sq. in. It is stated that 150 lbs. per sq. in. is the limit for the apparatus as at present designed, but improvements are under consideration with the object of raising this limit to a higher figure.

Organizations

American Concrete Institute; Secretary, Harvey Whipple, 1807 East Grand Boulevard, Detroit. Convention, Cincinnati, Ohio, January 22-25, 1923.

American Concrete Pipe Association, M. W. Loving, Secretary, 111 West Washington St., Chicago.

Associated Metal Lath Manufacturers, Edison Bldg., Chicago; Wharton Clay, Commissioner.

Portland Cement Association; William M. Kinney, General Manager, 111 West Washington Street, Chicago.

Iowa Cement Stave Silo Association; H. E. Kilmer, Secretary, Oskaloosa, Ia.

Mid-West Concrete Products Assn., Frank Whipperman, Secretary-Treasurer, 3045 Fowler Bldg., Omaha, Neb.

National Crushed Stone Assn.; A. P. Sandles, Secretary, 405 Hartman Bldg., Columbus, Ohio.

National Housing Assn.; Lawrence Veiller, Secretary and Director, 105 East 22nd St., N. Y. C.

The National Lime Association; Mather Bldg., Washington, D. C.

National Sand and Gravel Producers' Association; T. R. Borrows, Acting Secretary, 903 Munsey Bldg., Washington, D. C.

The National Concrete Stave Silo Association; W. G. Kaiser, Secretary, 111 West Washington St., Chicago.

Concrete Mixed in Transit on Kansas City Job

The illustrations show how concrete paving was done on Tenth street in North Kansas City, Mo., by the Bickel Contracting Co., one picture showing the loading of transit mixers, the other the discharge of these mixers at the job. The machines, with mixer mounted on a Ford chassis, are built by the Transit Mixer Co., Kansas City.

The use of the equipment on the Tenth street paving is described by N. M. Fitch, chief engineer, North Kansas City Development Co., for which the work was done.

Three Ford trucks were used, upon the chassis of each of which was mounted a specially designed mixing drum, rotated by the truck motor, while in transit from the loading bins to the point of discharge, by means of a drive shaft and gears attached to the front end of the crank shaft of the motor. The mixing drums were loaded from central storage bins adjacent to the switch track, where materials were received and unloaded into the bins. A measuring hopper received the sand, rock and cement from the bins and discharged them directly into the mixing drum of the waiting motor truck. A proper amount of water was then added and the truck started to the job.

The motor drum is rotated during the charging operation and continues to rotate, mixing the concrete while in transit from the material bins to the job. The concrete when discharged on the job is well mixed and of a uniform mass, ready to be spread by the workmen. The concrete pavement on this particular job was finished with template, roller and belt.

The loading and charging plant (Fig. 1) consists of a compact rock bin, sand bin and cement storage shed. The materials are unloaded from cars into storage piles, which feed directly into the boot of a bucket elevator. The elevator handles both sand and rock, and is driven by a gasoline engine. When materials adjacent to the elevator boot are exhausted, and no cars are on the track, the material is pulled to the boot by means of a back-fill scraper. The cement is handled directly from the car to the charging platform, when a car is on the siding, otherwise the cement comes from the storage

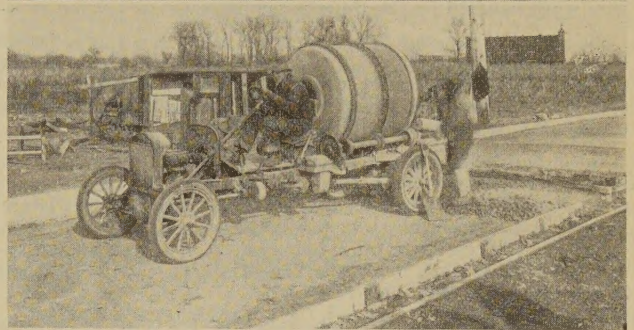
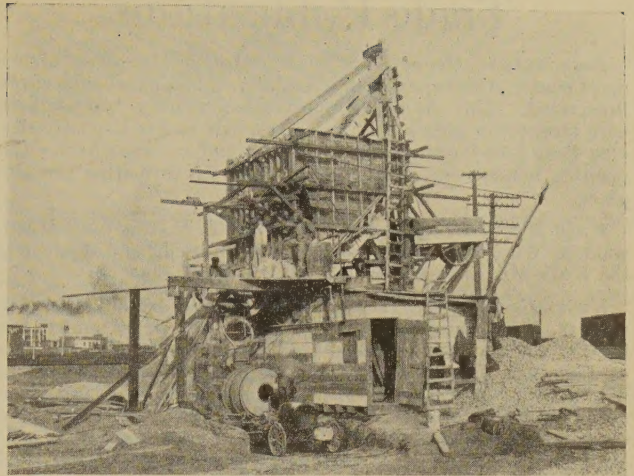


FIG. 1—LOADING TRANSIT MIXERS AT BINS ON KANSAS CITY PAVING JOB

FIG. 2—DISCHARGING THE BATCH ON THE SUBGRADE

shed through a trap door to charging platform. The materials are fed by gravity from the bins into the measuring hopper, which handles a uniform charge for each batch. This hopper answers the double purpose of measuring the charge and feeding the mixer.

Fig. 2 shows the machines discharging on the job, and serve to illustrate the adaptability of the machine in placing and spreading the concrete, thus reducing the hand spreading operation to a minimum.

This entire job, from unloading materials to finishing the pavement, including sub-grading, mixing, hauling, spreading concrete and finishing the pavement, was handled by a crew of fourteen men. Work cannot be stopped by the failure of a mixer, as in the old method, where only one mixer is used, for there are as many mixers as there are trucks, and the stoppage of any one truck does not impair the operation of the others. Neither is the contractor limited in his output to a single mixer, but can make his output anything he wishes by adding additional trucks to his fleet.

The Anaconda Copper Mining Co. has recently started to manufacture copper shingles, in three sizes, 6 by 18 in., 8 by 18 in., and 8 by 60 in. This roofing weighs approximately 84 pounds a square of 100 ft. It is made of an especially developed pure copper.

The Heer Concrete Pipe Machine—Heer Manufacturing Co., Narod, via Ontario, Cal., 16 pages and cover, 6 $\frac{3}{4}$ in. by 9 $\frac{3}{4}$ in.; describing and illustrating a machine for the manufacture of concrete pipe. It was built by O. Johnson and Otto F. Heer, as a result of Johnson's early experience in the manufacture of concrete irrigation pipe by hand tamping methods. A statement in the catalog puts the daily production of the machine at from 900 to 1,000 ft. of 6-in. pipe; to 400 to 500 ft. of 24-in. pipe (with proportional quantities for intermediate sizes), with four or five men operating the plant.

Holt Roof Leader and Vent Connections—The Barrett Co., 28 pages and cover, 3 $\frac{3}{4}$ in. by 8 $\frac{1}{2}$ in., illustrating and describing, with construction details, various roof connections employed with flat or sawtooth roof construction for vent pipe, leader lines, steam stacks, flag poles, and so on.

Trade Publications

Boss Mixers—Heavy Duty Type, Catalog B 23—The American Cement Machine Co., Inc., Keokuk, Ia., 28 pages and cover, illustrated. This catalog describes heavy duty type mixers, with steel roller pinion drive, all sizes, half to five-bag capacity, also Boss 2-in-1 combination building and paving mixer. Capacities, horsepower, shipping and export information are also given.

Kwik-Mix Concrete Mixer—Badger Wire & Iron Works, Milwaukee, Wis., folder in three colors, illustrating and describing the Kwik-Mix mixers Nos. 1, 2, 10, 11, 12, 30, and 33.

Kwik-Mix Concrete Mixer—Badger Wire & Iron Works, Milwaukee, Wis., Catalog, 6¾ in. by 10 in., 16 pages and cover, in two colors. This catalog points out the special features of this line of mixers, different numbers being described in detail, with illustrations. The hoist control is diagrammed in each particular and extracts are given from letters of contractors using the Kwik-Mix. Page 16 is devoted to illustrations and descriptions of various types of builders' iron and wire work handled by the Badger company.

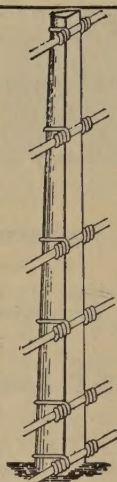
Silicate of Soda and Concrete is the title of a folder issued by the Philadelphia Quartz Co., 121 S. Third St., Philadelphia, making special announcement of "N" brand silicate of soda solution, weighing 11¼ lbs. to the gallon, put up for application to concrete as a surface filler and hardener.

Boca Solid Steel Sash, Catalog E-22—The Bogert & Carrough Co., Paterson, New Jersey; 11½ in. by 8½ in., 24 pages and cover, illustrated, describing sidewalk sash, underwriters' labeled sash, basement sash, power house sash, monitor sash, operating devices, doors and partitions, constructions and dimensions being given in detail. The Boca patented lock-joint is also described and illustrated.

Medusa Waterproof Cement Paint is the subject of two little folders issued by the Sandusky Cement Co., Cleveland, Ohio, to introduce its new product, Medusa Waterproof Cement Paint. One folder describes the use of this paint to brighten "damp, dark and leaky basements," while the other describes its use in covering the surfaces of stucco and concrete houses. It is claimed that this paint (which comes in

powder form) mixes readily, forms a perfect emulsion with water, and spreads smoothly and easily; that it does not deteriorate with age or exposure to moisture. One pound of the dry powder when mixed with water will cover 12 to 15 sq. ft. of surface on concrete, stucco, brick and tile. Medusa waterproof cement paint is produced in white, cream buff, and stone gray, and it is expected that it will soon be produced in red and green also.

Architects Specification Handbook—Truscon Laboratories, Detroit, Mich.; loose-leaf, 52 sheets and flexible cover; 8½ x 11 in.; printed in two colors: is intended to give architects and engineers the information they require for specifying waterproofings, dampproofings, oilproofings, floor hardeners, and protective finishes. Every effort has been made to make the book as clear and concise as possible. Specifications are printed on each right-hand page, with a description of the particular product on the back. A list of prominent users is also included. Large bold-face type on the upper right-hand edge of each page tells easily the contents of the page.



"D. & A." CEMENT FENCE POSTS are made SIX or TEN at ONCE

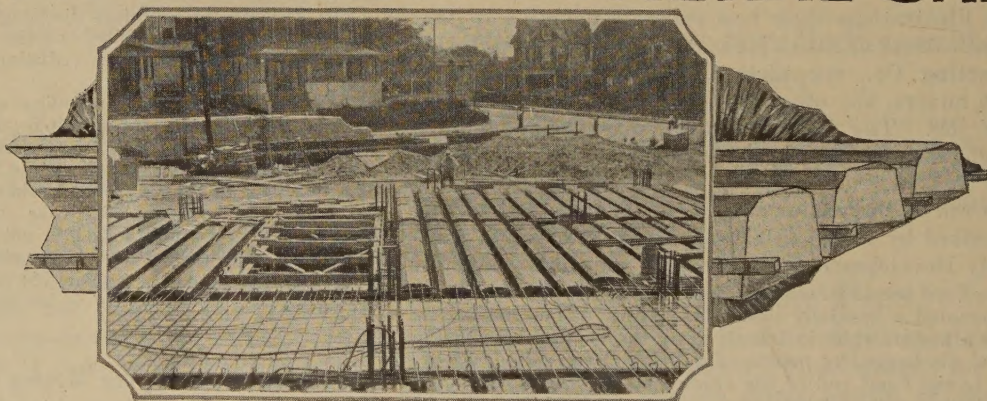
Start a good paying business, or addition to your own today. Small investment, easy work, reliable customers, years of advertising has created large demand for "D. & A." Posts and we require local dealers to make posts. Now in general use in all parts of the world.

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Send for FREE Catalog and Prices today

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USE D & R SYSTEM with NUMERAL-BARS



The Numeral Bar

The only deformed reinforcing bar on the market which has a **Labor-Saving Feature**. It has deformations rolled into the metal at short intervals, which indicate the size of the bar, marked in eighths of an inch, as 3 for ¾, 4 for ½, 5 for ⅜, up to 10 for 1¼ bar.

This means a saving of several dollars per ton in the cost of sorting, racking and placing reinforcing bars. Insures Architects and Engineers against mistakes made by laborers in setting and sorting bars.

The D. & R. System

A special patented method of forming concrete joists with No. 16 gauge removable metal forms combined with a very simple and economical method of wood framing for supporting the concrete joists and metal forms. A metal lath ceiling can be applied after removal of forms to 10 d. nails imbedded in the concrete joists about six inches on centers. The D. & R. System requires **less labor** to erect the wood framing (as it has only one-third the number of pieces of lumber to handle that competitive systems have) and **less labor** to erect the lath ceiling than any other system on the market.

Write for our booklets.



National Concrete Metal Forms Corporation
342 Madison Ave.
New York City

Warehouse Stocks of Bars located at Schuylkill-Haven, Pa.; Newark, N. J.; Perth Amboy, N. J.

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